DOCUMENT RESUME

ED 449 580 EA 030 868

AUTHOR Aneckstein, Laura; Baird, Andrea; Butler, Margaret; Chambers, David; Johnson, Wanda; Kraus, Rebecca; Mann, Eric; Trost, Tami; Zalokar, Nadja; Zieseniss, Mireille

TITLE Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX. Equal Educational Opportunity Project Series, Volume V.

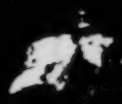
INSTITUTION Commission on Civil Rights, Washington, DC.
PUB DATE 2000-07-00
NOTE 175p.; With contributions by Valerie Blanks, Monique Cueto, Asha Gibson, Elena Grigera, Renee Enochs, LaTasha Greer, Jeanette Johnson, and Catherine Kim. Fifth report in the Equal Educational Opportunity Project Series. Prepared under the direction and supervision of Frederick D. Isler.
PUB TYPE Reports - Evaluative (142)
EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS *Disability Discrimination; Elementary Secondary Education; Emotional Problems; *Equal Education; Government Publications; Limited English Speaking; Mathematics; *Minority Groups; Public Schools; Sciences; *Sex Bias; *Social Discrimination

ABSTRACT

This report focuses on the Office for Civil Rights' (OCR's) activities relating to Title IX and advanced mathematics, science, and technology education for girls. It examines some of the barriers and inequities that undermine girls' opportunities to choose college majors and enter careers in the advanced mathematics, science, and technology fields, thus preventing them from having an equal opportunity to participate in advanced mathematics and science education programs, to maximize their learning potential, and to enhance their educational and career opportunities overall. The report also acknowledges gender differences placing boys at a disadvantage (for example, boys' underachievement in reading). The report evaluates and analyzes OCR's implementation, compliance, and enforcement efforts under Title IX. It discusses other federal laws affecting advanced mathematics and science education to the extent they relate to Title IX and advanced mathematics, science, and technology education. The report provides findings and recommendation regarding OCR's Title IX implementation, compliance, and enforcement efforts to assist the Department of Education and OCR in improving and strengthening the Title IX program. (Contains tables and figures.) (DFR)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 449 580



SCOPE OF INTEREST NOTICE

The ERIC Facility has assigned this document for processing to: EA

In our judgment, this document is also of interest to the Clearinghouses noted to the right. Indexing should reflect their special points of view. 30

Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX

Equal Educational Opportunity Project Series
Volume V

July 2000

A Report of the United States Commission on Civil Rights

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

EA 030 568

2

BEST COPY AVAILABLE

U.S. Commission on Civil Rights

The U.S. Commission on Civil Rights is an independent, bipartisan agency first established by Congress in 1957 and reestablished in 1983. It is directed to:

- Investigate complaints alleging that citizens are being deprived of their right to vote by reason of their race, color, religion, sex, age, disability, or national origin, or by reason of fraudulent practices.
- Study and collect information relating to discrimination or a denial of equal protection of the laws under the Constitution because of race, color, religion, sex, age, disability, or national origin, or in the administration of justice.
- Appraise Federal laws and policies with respect to discrimination or denial of equal protection of the laws because of race, color, religion, sex, age, disability, or national origin, or in the administration of justice.
- Serve as a national clearinghouse for information in respect to discrimination or denial of equal protection of the laws because of race, color, religion, sex, age, disability, or national origin.
- Submit reports, findings, and recommendations to the President and Congress.
- Issue public service announcements to discourage discrimination or denial of equal protection of the laws.

Members of the Commission

Mary Frances Berry, *Chairperson*
Cruz Reynoso, *Vice Chairperson*
Carl A. Anderson
Christopher F. Edley, Jr.
Yvonne Y. Lee
Elsie M. Meeks
Russell G. Redenbaugh
Victoria Wilson

Ruby G. Moy, *Staff Director*

This report is available on diskette in ASCII and WordPerfect 5.1 for persons with visual impairments. Please call (202) 376-8110.

SCOPE OF INTEREST NOTICE

The ERIC Facility has assigned this document for processing to: EA

In our judgment, this document is also of interest to the Clearinghouses noted to the right. Indexing should reflect their special points of view. SO

Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX

Equal Educational Opportunity Project Series
Volume V

July 2000

A Report of the United States Commission on Civil Rights

Letter of Transmittal

The President
The President of the Senate
The Speaker of the House of Representatives

Sirs:

The U.S. Commission on Civil Rights transmits this report, *Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX*, pursuant to P.L. 103-419. This report is the result of the Commission's longstanding commitment to ensuring that the nation's public schools are free of discrimination and that all children in this country are afforded equal educational opportunity. The purpose of this report is to evaluate the efforts of the U.S. Department of Education (DOEd) and its Office for Civil Rights (OCR) to enforce Title IX of the Education Amendments Act of 1972.

The first report of the *Equal Educational Opportunity Project Series* evaluated and analyzed OCR's history, performance, regulations, policies, and activities, setting the stage for the remaining reports. The second report, *Equal Educational Opportunity and Nondiscrimination for Students with Disabilities: Federal Enforcement of Section 504*, evaluated and analyzed OCR's Section 504 performance, regulations, policies, and activities specifically relating to the development of individualized education programs for and placement of students with mental retardation, learning disabilities, behavioral disabilities, or serious emotional disturbance. The third report, *Equal Educational Opportunity and Nondiscrimination for Students with Limited English Proficiency: Federal Enforcement of Title VI and* Lau v. Nichols, evaluated and analyzed OCR's Title VI performance, regulations, policies, and activities relating to the development and implementation of educational programs for and placement of national origin minority students identified as having limited English proficiency. The fourth report, *Equal Educational Opportunity and Nondiscrimination for Minority Students: Federal Enforcement of Title VI in Ability Grouping Practices*, evaluated and analyzed OCR's Title VI performance, regulations, policies, and activities relating to ability grouping and tracking of minority students.

With this report, the Commission focuses on OCR's activities relating to Title IX and advanced mathematics, science, and technology education for girls. It examines, within the context of educational practices, some of the present-day barriers and inequities that undermine girls' opportunities to choose college majors and enter careers in the advanced mathematics, science, and technology fields. Such practices may prevent girls from having an equal opportunity to participate in advanced mathematics and science education programs, to maximize their learning potential, and to enhance their educational and career opportunities overall. While focusing on mathematics and science education, the report also acknowledges gender differences placing boys at a disadvantage, such as boys' underachievement in reading, compared with girls.

This report evaluates and analyzes OCR's implementation, compliance, and enforcement efforts under Title IX. It discusses other federal laws affecting advanced mathematics and science education for girls, such as the Equal Educational Opportunities Act of 1974, the Women's Educational Equity Act, and Goals 2000: Educate America Act, to the extent they relate to Title IX and advanced mathematics, science, and technology education for girls.

The report provides findings and recommendations regarding OCR's Title IX implementation, compliance, and enforcement efforts in order to assist the Department of Education and

its Office for Civil Rights in improving and strengthening OCR's Title IX program and promoting nondiscrimination and equal educational opportunity for girls in advanced mathematics and science education. The Commission finds that, in general, OCR Title IX enforcement has been adequate in addressing the need to ensure nondiscrimination in academic programs.

However, the report contains specific recommendations to further strengthen OCR in its efforts to enforce Title IX. Because of persisting stereotypes, which affect career choices, the labor force, and ultimately the competitiveness of the United States as a nation, the Department of Education, in conjunction with Congress, should ardently fight to eliminate the discrimination that hinders women's and girls' educational opportunities. Congress should continue to support the elimination of gender bias from curricula, textbooks, and other educational materials by providing additional funding for programs authorized under the Women's Educational Equity Act. Further, in conjunction with the U.S. Department of Labor and program offices within DOEd, such as the Women's Educational Equity Act program and the Office of Elementary and Secondary Education, OCR should develop programs aimed at removing gender stereotypes attached to certain occupations.

Overall, the Commission finds that factors such as diagnostic and screening procedures and ability grouping and tracking can have a profound effect on educational outcomes. In addition, parents, teachers, counselors, and school resources can shape a student's learning experiences. Thus, the Commission recommends several Title IX compliance and technical assistance strategies to ensure equal opportunity for girls in math, science, and technology education. Foremost, OCR should review schools for Title IX compliance in regard to math and science education and provide technical assistance to schools to ensure compliance. For example, OCR should conduct compliance reviews to determine whether there is gender bias in achievement and aptitude tests, particularly in schools where there is an underrepresentation of girls in advanced placement mathematics, science, and technology, or gifted and talented math and science programs. In addition, OCR should update and finalize policy guidance currently in draft form and develop guidance on other issues related to the provision of equal opportunity for girls in math-, science-, and technology-related fields. OCR should develop guidance to clarify the duties imposed on educational institutions by the Equal Protection Clause and Title IX with regard to single-sex education.

OCR also must encourage schools to involve parents through technical assistance and outreach and education activities, including wider dissemination of its pamphlet offering suggestions for involving parents in mathematics and science programs. Further, teachers periodically should be provided diversity training, and knowledge of diversity issues should be part of the accreditation process. In reviewing teacher performance, school administrators should identify teacher behaviors and interactions, whether intentional or not, that could hinder equal academic development of boys and girls.

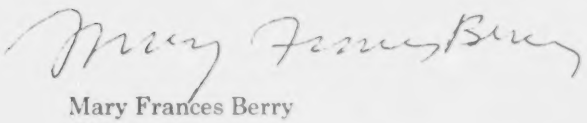
The Commission also recommends that OCR expand its technical assistance and outreach and education efforts to ensure that parents and educators alike are more fully equipped to address the barriers affecting girls' participation in advanced mathematics, science, and technology education. For example, OCR must collaborate with DOEd's Office of Elementary and Secondary Education and the Women's Educational Equity Act program office, the Women's Bureau of the U.S. Department of Labor, the National Science Foundation, and outside agencies and organizations to develop special emphasis programs to encourage girls to participate in math, science, and technology endeavors.

For nondiscrimination and equal educational opportunity to be ensured in our nation's public schools, the Department of Education must work hand in hand with school administrators, teachers, students, parents, and the community at large to provide both educational equity and educational excellence to all students regardless of race, color, national origin,

gender, or disability. The Commission's intention, with this report, is to assist the Department of Education in its efforts to strengthen its partnerships with these groups and thereby enhance the Department's Title IX civil rights enforcement program.

Respectfully,

For the Commissioners



Mary Frances Berry
Chairperson

Preface

This is the fifth report to be published as part of the Commission's *Equal Educational Opportunity Project Series*. The project focuses on the opportunities available to students in American public elementary and secondary education. The purpose of this project is to evaluate the efforts of the U.S. Department of Education (DOEd) and its Office for Civil Rights (OCR) to enforce laws mandating equal educational opportunity, with particular attention to programs provided children with disabilities; the education offered to children with limited English proficiency; ability grouping and tracking of minority children; and the participation of girls in advanced mathematics, science, and technology education programs.[1] In conducting the project, the Commission evaluates educational practices and policies relating to DOEd's civil rights enforcement efforts, and the Commission focuses on areas to improve the quality and distribution of educational opportunities. The Commission has undertaken this project to produce a series of reports benefiting a variety of audiences, including the President, Congress, DOEd, state and local educational agencies, the general public, parents, and, most importantly, students in America's public elementary and secondary schools.

The Commission has sought to identify key issues faced by students within public schools and classrooms.[2] In meeting this task, the Commission has focused on four issues for this project:

1. Development of individualized education programs for and placement of students classified as educable mentally retarded, students with learning disabilities, students with behavioral disabilities, and students with serious emotional disturbance.
2. Development of educational programs for and placement of students with limited English proficiency.
3. Ability grouping and tracking of minority students.
4. Difficulties faced by female students in gaining equal access to advanced mathematics and science courses or educational programs.

These four issues encompass some of the educational practices that exist currently in America's schools. They serve as avenues for exploring some of the present-day barriers and inequities faced by students. These four issues are of great concern to parents and students, and they form the basis of various discrimination complaints filed by individuals throughout the country.[3] Moreover, in the early 1990s and continuing to the present, DOEd and OCR

---

[1] *The Equal Educational Opportunity Project Series* addresses the following civil rights and program statutes: (1) Title VI of the Civil Rights Act of 1964; (2) Title IX of the Education Amendments of 1972; (3) Section 504 of the Rehabilitation Act of 1973; (4) Equal Educational Opportunity Act of 1974 (EEOA); and (5) Education for All Handicapped Children Act of 1975 (renamed the Individuals with Disabilities Education Act (IDEA)). The Commission recognizes OCR does not have responsibility for enforcing the EEOA or the IDEA. The project reports discuss these laws only as they relate to OCR's responsibilities.

[2] Although private schools have a long tradition in the United States, this report's focus is on public elementary and secondary schools.

[3] From 1993 to 1995, the U.S. Department of Education's Office for Civil Rights (OCR) received a total of 11,484 elementary and secondary education complaints classified under one of the following bases: race, national origin, sex, or disability. *See* U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, 1996, chap. 5, table 5. Of the issues raised in elementary and secondary complaints received from 1993 to 1995, 1,700 involved either the assignment of students whose primary or home language is other than English, special education for LEP students, ability grouping or tracking, underrepresentation in math and science, or assignment of students with physical and mental impairments in which learning disabilities or mental retardation were a specified basis. *See* ibid., table 9. This figure does not include issues on the assignment of students with physical and mental impairments in which behavioral disability or serious emotional disturbance was a specified basis. OCR

have chosen to focus on many of these issues as priority topics in conducting educational research and performing civil rights compliance and enforcement activities.

Based on a review of literature, law, and policies, the Commission has identified five major principles that affect equal access to a quality education:

1. Structuring educational programs to serve a diverse student population by maintaining a primary objective to place students in regular classes and core academic curricula to the greatest extent possible; grouping students to reflect different ability in various subjects; reevaluating and regrouping students periodically to reflect both the different ability in various subjects and changes in achievement, performance, and development.
2. Using neutral and nondiscriminatory diagnostic and screening procedures when placing students in educational programs.
3. Providing parental notification and ensuring that institutional programs facilitate and encourage the involvement of parents in their children's education.
4. Evaluating and allocating teachers, facilities, and other resources among educational programs.
5. Eliminating barriers, providing access to all subjects, activities, and career opportunities, and counseling each student to maximize his or her potential opportunities.

Research groups, educators, and other professionals have done studies and published articles on many of these issues and principles. However, to date, no one project has addressed all in a comprehensive and integrated fashion. As an independent, bipartisan agency, the Commission has undertaken this project series to study these topics and present its findings and recommendations in a comprehensive series of enforcement reports. The reports discuss steps taken by the Federal Government, state and local educational agencies, and schools to prevent discrimination and to eliminate barriers to equal educational opportunity. Furthermore, the Commission's reports strive to promote nondiscrimination and equal educational opportunity by discussing criteria for evaluating educational practices from a civil rights perspective. By providing information on civil rights principles to consider when developing and implementing educational programs, the Commission hopes to support the efforts of the Federal Government, states, local schools, parents, teachers, and students as they work together to promote equal educational opportunities for all students.

In the *Equal Educational Opportunity Project Series* the Commission evaluates OCR's implementation, compliance, and enforcement efforts at several levels—headquarters, regional, state, and local. The Commission has undertaken the following activities in preparing this report: (1) at the regional level, the Commission interviewed staff in selected OCR regional offices;[4] (2) the Commission assessed OCR's procedures and organization at the headquarters and regional levels to determine whether they are sufficient and effective for the enforcement of civil rights laws for the project's focus issues; (3) the Commission reviewed OCR's policies and regulations implementing civil rights laws; (4) the Commission determined the extent to which these policies and regulations conform with the civil rights laws; and (5) the Commission reviewed OCR's efforts in conducting compliance reviews, complaint investigations, monitoring, and providing technical assistance, outreach, education, and training for the project's main issues.

In December 1996, the Commission published *Equal Educational Opportunity Project Series, Volume I*, a precursor to this report. The report is the initial statutory enforcement re-

---

does list these types of disabilities as specific bases. *See* U.S. Department of Education, Office for Civil Rights, *Using OCR's Case Information System for Windows (CIS II)*, p. SB-1.

[4] The Commission conducted onsite and telephone interviews with staff members at OCR's Region IV office in Atlanta, Georgia. It conducted telephone interviews with staff members in the following other OCR regional offices: Region II—New York, NY; Region III—Philadelphia, PA; Region VI—Dallas, TX; Region VII—Kansas City, MO; Region VIII—Denver, CO; Region IX—San Francisco, CA; and Region X—Seattle, WA.

port in a series discussing implementation, compliance, and enforcement of civil rights laws relating to the above four focus issues in public elementary and secondary education. Because the civil rights laws addressed in this project cover DOEd's federal financial assistance programs, this volume also provided a summary of DOEd's programs to inform the reader of the specific educational programs covered by the civil rights laws. Volume I also discussed national trends in education generally and trends relevant to issues discussed in the project series. This report also evaluated and analyzed the history, performance, regulations, policies, and activities of OCR. The Commission offered its initial enforcement report in the series with findings and recommendations regarding the overall implementation, compliance, and enforcement efforts of OCR relating to the four focus issues in public elementary and secondary schools.

Volume II, *Equal Educational Opportunity and Nondiscrimination for Students with Disabilities: Federal Enforcement of Section 504*, focused on the development of individualized education programs for and placement of students with mental retardation, students with learning disabilities, students with behavioral disabilities, and students with serious emotional disturbance. Volume III, *Equal Educational Opportunity and Nondiscrimination for Students with Limited English Proficiency: Federal Enforcement of Title VI and* Lau v. Nichols, focused on the development and implementation of educational programs for students identified as having limited English proficiency. Volume IV, *Equal Educational Opportunity and Nondiscrimination for Minority Students: Federal Enforcement of Title VI in Ability Grouping Practices*, focused on ability grouping and tracking of minority students.

The present report, the fifth in the series, *Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX*, is one of four volumes that focus on the four focus issues listed above. This report evaluates the difficulties faced by female students in gaining equal access to advanced mathematics, science, and technology courses.

With *Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX*, the Commission takes a closer look at Title IX of the Education Amendments of 1972; OCR's implementation, compliance, and enforcement of that law; and the regulation requirement to provide equal educational opportunities for girls in advanced mathematics, science, and technology education. The report's purpose is to evaluate federal enforcement of Title IX as it relates to educational opportunities for girls in these courses.

This report does not examine OCR's general process for civil rights implementation, compliance, and enforcement (i.e., OCR's organization, budget, staffing levels, and complaints and compliance procedures). These civil rights areas were examined in volume I. Instead the report analyzes civil rights from a civil rights policy perspective. It examines federal enforcement of Title IX in the context of specific principles that advance equal educational opportunity and promote nondiscrimination. This report serves as a statutory enforcement report, offering findings and recommendations regarding the specific activities of DOEd's OCR relating to girls' opportunities in advanced mathematics, science, and technology education. It discusses the educational and civil rights perspectives on this issue and summarizes various theories, research, and assessments of educational experts. To the extent DOEd or OCR has encouraged or recommended certain educational practices as consistent with civil rights initiatives, the report discusses DOEd's or OCR's activities to support the practices. The report then assesses the implementation, compliance, and enforcement of civil rights laws by OCR. By integrating an understanding of both educational practices and civil rights enforcement, the Commission emphasizes the importance of providing both educational equity and educational excellence to all students regardless of race, color, national origin, gender, or disability.

The Commission intends to use the report to ensure school districts accurately assess girls' interest or talent in advanced mathematics and/or science courses; work to develop appropriate mathematics and science placements and effective participation in these courses;

steer girls who are interested toward participation in advanced mathematics and/or science courses and careers in these fields; and ensure effective participation for girls in advanced mathematics and science classes by addressing barriers created by teachers, parents, and other students. Because the Equal Educational Opportunities Act of 1974 and its interpretation by the federal courts offer a further prohibition against discrimination on the basis of sex in educational programs, it is addressed as it relates to Title IX. The discussion provides a basis for showing how OCR can further incorporate educational standards and principles into its Title IX program. The report also analyzes how OCR has worked and should continue to work in concert with the Office of Elementary and Secondary Education, which administers the Women's Educational Equity Act program, to promote gender equity and effective participation for girls in advanced mathematics and science education.

Acknowledgments

This report was prepared under the direction and supervision of Frederick D. Isler,* assistant staff director for civil rights evaluation. The report was written by the staff of the Office for Civil Rights Evaluation, including Laura Aneckstein,* civil rights analyst; Andrea Baird,* social scientist; Margaret Butler, civil rights analyst; David Chambers,* civil rights analyst; Wanda Johnson, civil rights analyst; Rebecca Kraus, social scientist; Eric Mann,* civil rights analyst; Tami Trost,* civil rights analyst; Nadja Zalokar,* supervisory civil rights analyst; and Mireille Zieseniss, civil rights analyst. Valerie Blanks, intern, Howard University; Monique Cueto, intern, Georgetown University; Asha Gibson, intern, Howard University; and Elena Grigera, extern, Cornell University, also made significant contributions to the writing of and research for this report. Renee Enochs, intern, Howard University; LaTasha Greer, intern, Howard University; Jeanette Johnson, intern, Howard University; and Catherine Kim, extern, Cornell University, assisted with research for and writing of this report. Barbara Fontana and Vanessa Williamson also assisted in obtaining research materials. The legal review was performed by Peter Reilly, attorney-advisor. Editorial review was provided by Constance M. Davis, Emma Monroig, and Marcia Tyler. Dawn Sweet provided editorial assistance and prepared the report for publication.

* No longer with the Commission.

Contents

Preface vii

1. Introduction 1

2. Background 8
A Historical Perspective: The Education of Women in America 8
The Effect of Attitudes about Women's Roles 8
The Evolution of Education for Women 10
Post-Civil Rights Era Initiatives to Improve Educational Opportunities for Women 12
Title IX of the Education Amendments of 1972 12
Women's Educational Equity Act 13
The Current Status of Women and Girls in Math, Science, and Technology 14
Elementary and Secondary Schools 15
Colleges and Universities 16
Math, Science, and Technology Careers 17
Factors Affecting Girls' Participation in Advanced Math, Science, and Technology 17
Attitudes toward Math and Science 17
Socialization and Stereotypes 19
Self-Esteem 21
Learning Styles 23
Counseling and Role Models 24
Discrimination and Sexual Harassment 25
A Study of Gender Gaps in Two Contexts 26
Gender Gaps in Computer Science and Technology 26
Software: A Child's Introduction to Technology 27
Experiences with Technology 28
Out-of-School Experience 28
In-School Experience 28
Computer Science and Technology Course Selection in Higher Education 29
Improving Computer Education 30
Underachievement by Males in Reading 30
OCR's Challenge: Ensuring Nondiscrimination through Title IX 32

3. Trends in Mathematics, Science, and Technology Education and Subsequent Employment for Girls and Women 33
Math and Science Participation and Achievement in Elementary and Secondary School: A Gender Comparison 33
Enrollment in Math and Science Courses 33
Elementary and Middle School 34
High School 34

Achievement in Math and Science 36
National Assessment of Educational Progress 36
Math Achievement 37
Science Achievement 37
Third International Mathematics and Science Study 41
College Entrance Exams 41
Math and Science Advanced Placement Exams 42
Postsecondary Education 44
College Plans 44
College and Graduate Degrees 44
Women in Science and Engineering Fields 46
Educational Background 46
Employment 46
Salaries 47

4. The Department of Education: Ensuring Nondiscrimination and Promoting Gender Equity 48
Responsibility for Civil Rights Enforcement and Gender Equity Programs 48
Office for Civil Rights 48
Mission and Function 48
Strategic Planning 48
Budget 49
Office of General Counsel 49
Office of Elementary and Secondary Education 50
Women's Educational Equity Act Program 51
OCR's Interaction with OESE 53
OCR's Title IX Implementation, Compliance, and Enforcement Efforts 54
Title IX Statute 54
Title IX Regulations 55
Admissions and Recruitment 55
Educational Programs 56
Employment Discrimination 56
Proving Discrimination under Title IX 56
Disparate Treatment 57
Disparate Impact 58
Title IX Policy, Guidance, and Investigative Procedures 60
OCR's Investigative Manual 60
Site Selection for Compliance Reviews 61
Investigative Process 61
Resource Guidance 64
OCR's Enforcement Efforts 65
Compliance Reviews and Complaint Investigations 65
Letters of Finding 67
Technical Assistance, Outreach, and Education 68
Promising Practices and Models 68
Technical Assistance Brochure 69

5. Using Neutral and Nondiscriminatory Screening and Diagnostic Procedures 70
Barriers to Neutral Screening and Diagnostic Procedures 70
Gender Differences in Test Results 70
Eliminating Bias to Achieve Test Fairness 71
Federal Efforts to Address Biased Diagnostic Procedures 74
Women's Educational Equity Act 74
Title IX Regulations 75
OCR's Enforcement Efforts 75
Title IX Policy Guidance 75
High-Stakes Testing Guidance 75
Fairness in Testing Guidance 76
Investigations and Monitoring 76
Investigative Methods 76
Cases on Screening and Diagnostic Procedures 77
Technical Assistance, Outreach, and Education 78

6. Facilitating Girls' Achievement in Math, Science, and Technology: Parents, Teachers, Counselors, and School Resources 80
Parental Notification and Involvement 80
Educational Research 80
Programs and Initiatives 82
OCR's Enforcement Efforts 85
Title IX Regulations and Policy 85
Technical Assistance, Outreach, and Education 85
Investigations and Monitoring 86
Teachers and Counselors 87
The Role of Teachers 87
The Role of Counselors 90
Initiatives to Improve Teaching and Counseling Services 92
OCR's Enforcement Efforts 92
Title IX Regulations and Policy 92
Technical Assistance 93
Compliance Reviews and Complaint Investigations 93
Providing Comparable Resources and Equal Access to Technology 94
Research Studies 95
Policies and Initiatives 96
OCR's Enforcement Efforts 97
Title IX Regulations and Policy 97
Technical Assistance 98

7. Structuring Academic Programs to Ensure Gender Equity 100
Grouping and Tracking of Girls in Math and Science 100
OCR's Policy and Investigative Guidance 102
Compliance Reviews and Complaint Investigations 103
Methods for Investigating Grouping Practices 103
Cases on Grouping of Girls in Math and Science 104
Single-Sex Education 104
The Debate over Single-Sex Education 105
The Case for Single-Sex Education 105
The Case against Single-Sex Education 106
Finding Middle Ground in the Single-Sex Debate 108

Federal Law on Single-Sex Education 109
Title IX of the Education Amendments of 1972 109
Equal Educational Opportunities Act 110
Equal Protection Clause 110
Case Law Relevant to Single-Sex Education 111
Single-Sex Schools at the Postsecondary Level 111
Single-Sex Schools at the Elementary and Secondary Levels 112
OCR's Implementation, Compliance, and Enforcement Efforts 114
Title IX Regulations 114
Policy Guidance 115
Cases on Single-Sex Education 116
Single-Sex Classes 116
Single-Sex Schools 117

8. Findings and Recommendations 120

Statements

Chairperson Mary Frances Berry, Vice Chairperson Cruz Reynoso, and Commissioners Christopher Edley, Jr., Yvonne Y. Lee, and Elsie M. Meeks 151
U.S. Commission on Civil Rights, Office of Civil Rights Evaluation Staff 152
Commissioners Carl A. Anderson and Russell G. Redenbaugh 156

Tables

2.1 Persons 18 and Over with a Bachelor's Degree or Higher, by Sex and Field of Study, 1993 16
3.1 Math and Science Course Enrollment of 1994 High School Graduates, by Gender 34
3.2 Self-Reported Math and Science Course Taking by College-Bound Seniors Taking the 1998 SAT, by Gender 36
3.3 Students at or above Selected NAEP Mathematics Proficiency Levels, by Gender, 1996 40
3.4 Students at or above Selected NAEP Science Proficiency Levels, by Gender, 1996 40
3.5 Mean Math SAT Scores, by Gender, Selected Years 42
3.6 SAT II Scores, by Gender, 1998 42
3.7 Average ACT Scores, by Gender, Selected Years 42
3.8 Advanced Placement Test Participation, by Gender, 1998 43
3.9 Advanced Placement Test Scores, by Gender, 1998 44
4.1 WEEA Program Budget, 1992–1998 52

Figures

3.1 Average Mathematics Proficiency, by Age and Gender, 1973–1996 38
3.2 Average Science Proficiency, by Age and Gender, 1973–1996 39
3.3 Planned Advanced Standing in College Courses of SAT Takers, by Gender, 1998 45
3.4 Planned College Major of SAT Takers, by Gender, 1998 45

CHAPTER 1

Introduction

The myth that mathematics and science are male domains began many centuries ago and persists into modern times. Current research still shows that sex bias in schools and in the workplace inhibits females from reaching their full potential in mathematics, science and technology.[1]

Over the past 30 years, this country has seen major changes for girls in mathematics and science education. While parity for girls and women in educational opportunity, and consequently in employment and economic opportunity, has proven an elusive goal, many of the changes during these years have been promising. Once excluded altogether from the possibility of taking advanced math and science classes, or neglected in terms of these educational courses, girls now are receiving more support in these areas, and public schools are required by law to assure equal opportunities for girls in mathematics and science. The change has come about through advocacy on behalf of women, heightened awareness of issues related to equal opportunity in education over the last 25 years, and the enactment of federal civil rights laws in the early 1970s assuring rights and protections for women in public education.

In public elementary and secondary education, two pieces of legislation have affected the education of girls in mathematics and science: Title IX of the Education Amendments of 1972[2] and the Women's Education Equity Act of 1974 (WEEA).[3] Title IX prohibits exclusion from, denial of the benefits of, or discrimination under federally assisted educational programs because of a person's sex.[4] The WEEA is a grant program created to promote educational equity for women in the United States by providing financial assistance to enable educational agencies and institutions to develop model gender equity programs and meet the requirements of Title IX.[5]

Title IX and its implementing regulations have offered a means for women to gain equal access to classes, activities, and educational services. The regulations implementing Title IX outline criteria for what constitutes compliance with Title IX, and, thus, nondiscrimination under the law.[6] The regulations address many educational practices, including admission to educational programs, counseling, appraisal materials, and nondiscrimination in testing for girls in public education.[7] They also cover topics such as comparable facilities and services.[8]

Much has changed in the education of girls since the enactment of Title IX in 1972 and the WEEA in 1974. Girls have made progress in advanced mathematics and science, earning comparable grades and exhibiting similar course-taking patterns in these subjects.[9] In June 1997,

---

[1] U.S. Department of Education (DOEd), Office for Civil Rights (OCR), *Equal Opportunity for Minorities and Women to Participate in Math and Science Courses*, Mar. 29, 1993, p. 6.

[2] Pub. L. No. 92-318, tit. IX, 86 Stat. 373 (codified as amended at 20 U.S.C. §§ 1681–1688 (1994)).

[3] Pub. L. No. 93-380, tit. IV, pt. B, § 408, 88 Stat. 554 (codified as amended at 20 U.S.C. §§ 7231–7238 (1994 & Supp. III 1997)).

[4] 20 U.S.C. § 1681(a) (1994). *See* chap. 2.

[5] 20 U.S.C. § 7232(2) (Supp. III 1997). *See* chap. 2.

[6] 34 C.F.R. pt. 106 (1998).

[7] *See generally id.*

[8] 34 C.F.R. § 106.33 (1998). *See* chap. 3.

[9] *See generally* Nancy S. Cole, *The ETS Gender Study: How Females and Males Perform in Educational Settings* (Princeton, NJ: Educational Testing Service, May 1997), prepublication copy.

the U.S. Department of Education (DOEd) released a report, *Title IX: 25 Years of Progress*, which provided a "snapshot" view of the progress girls and women have made since the enactment of Title IX. That report described women's increased educational attainment, particularly in mathematics and science, subjects previously dominated by men, and the influx of women into careers traditionally pursued by men. The report attributed much of the progress to successful implementation of Title IX.[10]

In the introduction to the report, the Secretary of Education, Richard W. Riley, noted that Title IX has had an enormous effect on educational opportunities for girls and women. According to the Secretary:

> What strikes me most about the progress that has been achieved since Title IX was passed in 1972 is that there has been a sea of change in our expectations of what women can achieve. More important, women have shown skeptics again and again that females are fully capable of being involved as successful and active participants in every realm of American life.[11]

In the 20th century, particularly since the enactment of Title IX in 1972, women made much progress in educational endeavors.[12] For example, women increased their college enrollment from 43 percent in 1972 to 63 percent in 1994.[13] Four times more women participated in intercollegiate athletes in the 1990s compared with the 1970s.[14] In addition, girls (and boys) are following a more rigorous curriculum than in the past,[15] and more girls than ever before are found in higher-level math and science courses, such as calculus, with the exception of physics and advanced placement courses.[16]

Women have also closed the gender gap in higher education.[17] Since 1984, women have outnumbered men in graduate schools. Among part-time graduate students, the number of women increased by 17 percent between 1986 and 1996, compared with a 1 percent increase for men.[18] In 1995–1996, 642,338 women earned bachelor's degrees, compared with 522,454 men. More women than men received master's degrees as well.[19]

Many organizations have praised the impact of Title IX. In 1996, the American Enterprise Institute and the Independent Women's Forum published a monograph on the economic progress of women, wherein they noted:

> Women have made considerable gains in education. Not only are they represented in greater numbers at the college and postgraduate levels; they have also steadily been entering traditionally male-dominated programs. In 1996, women represent 54 percent of the class admitted to Yale Medical School. In 1994, women earned more associate, bachelor's, and master's degrees than men.[20]

The National Coalition for Women and Girls in Education agreed that "there is no question that Title IX has had a significant impact on women and girls."[21] The American Association of University Women (AAUW) noted that "public schools *are* making progress toward equitable treatment of boys and girls."[22]

Nonetheless, barriers to equal education for women, particularly in math and science, remain.[23] In DOEd's 25th anniversary report, the

---

[10] U.S. Department of Education, *Title IX: 25 Years of Progress*, June 1997.

[11] Ibid., p. 1.

[12] *See* chap. 2 for a discussion of the history of women's education and barriers to women's education.

[13] DOEd, *Title IX: 25 Years of Progress*, p. 1.

[14] Ibid., p. 2.

[15] U.S. Department of Education, *Findings from the Condition of Education 1995: The Educational Progress of Women*, no. 5, NCES 96-768 (December 1995), p. 7 (hereafter cited as DOEd, *The Educational Progress of Women*).

[16] National Science Foundation, *Women, Minorities, and Persons with Disabilities In Science and Engineering: 1996*, NSF 96-311 (September 1996), p. xiii.

[17] DOEd, *Title IX: 25 Years of Progress*, p. 2. *See also* "Women, Blacks Gain In Educational Levels," *The Washington Post*, June 29, 1998.

[18] U.S. Department of Education, National Center for Education Statistics (NCES), *The Condition of Education 1998*, NCES 98-013 (October 1998), p. 187.

[19] NCES, *The Condition of Education 1998*, p. 276.

[20] Diana Furchtgott-Roth and Christine Stolba, *Women's Figures: The Economic Progress of Women in America* (Arlington, VA: Independent Women's Forum and the American Enterprise Institute, 1996), p. 16.

[21] National Coalition for Women and Girls in Education, *Title IX at 25: Report Card on Gender Equity*, 1997, p. 1.

[22] American Association of University Women (AAUW), *Gender Gaps: Where Schools Still Fail Our Children*, 1998, p. vii.

[23] *See generally* National Coalition for Women and Girls in Education, *Title IX at 25*; AAUW, *Gender Gaps*. *See also* DOEd, *Title IX: 25 Years of Progress*, pp. 1–2, 21–23; DOEd,

Secretary of Education also stated that while Title IX has had an enormous effect on educational opportunities for women and girls, improvement is still needed in several areas:

> Too many women still confront the problem of sexual harassment, women still lag behind men in gaining a decent wage, and only one-third of all intercollegiate athletic scholarships are granted to women. Clearly, much more remains to be done to ensure that every American is given an equal opportunity to achieve success without encountering the obstacle of gender bias.[24]

Although progress has been made on several fronts, differences between educational and employment opportunities for men and women are still apparent.[25] In July 1999, on the 27th anniversary of the enactment of Title IX, President William Jefferson Clinton made the following statement:

> Today we reflect upon the profound changes this legislation has helped bring about in American education, including: changing expectations of women's achievements; lowering the dropout rate for women; and increasing opportunities in math and science. Since 1971, dramatically greater numbers of women have completed postsecondary, graduate, and professional degrees. . . .
>
> While we have come a long way, there is still further progress to be made in undoing barriers to equal opportunity for women. We must continue to work to close the pay gap and ensure equal pay, enable men and women to meet their responsibilities for work and home, and end discrimination in the workplace. Too many women are paid less than men, and too many still experience discrimination in the workplace.
>
> As we move forward toward the eradication of discrimination based on gender, we celebrate Title IX and our nation's commitment to equality.[26]

While girls have narrowed the gender gap in mathematics and science, several key areas remain where girls continue to lag behind their male counterparts. For example:

- Girls are less likely to enroll in advanced mathematics and science courses such as physics, and they score 35 points below boys on the mathematics portion of the Scholastic Achievement Tests;[27] boys also continue to do better than girls on math portions of the Scholastic Assessment Tests.[28]
- Although, overall, girls are taking more advanced placement (AP) tests than boys, girls are less likely to take AP tests in calculus, computer science, and science,[29] and girls generally earn lower scores than boys.[30]
- Although more girls are enrolling in all math courses, girls are less likely than boys to take courses beyond algebra II, and boys far outnumber girls in physics and computer classes.[31]

These differences between boys and girls in elementary and secondary math and science education translate into differences in the rates at which women pursue postsecondary studies and eventually careers in math- and science-related fields. For instance:

- In computer science fields, women are underrepresented at all degree levels, and the proportion of degrees awarded to women in

---

The Educational Progress of Women, pp. 2–4, 16–17; DOEd, *Women in Mathematics and Science*, pp. 2–8, 11–17, 18–20; U.S. General Accounting Office, *Intercollegiate Athletics: Status of Efforts to Promote Gender Equity*, GAO/HEHS-97-10 (October 1996), p. 2.

[24] DOEd, *Title IX: 25 Years of Progress*, p. 1.

[25] Ibid.

[26] White House, Office of the Press Secretary, Statement by the President, June 23, 1999 accessed at <http://www.ed.gov/PressReleases/06-1999/wh-0623.html> on July 23, 1999.

[27] National Coalition for Women and Girls in Education, *Title IX at 25*, p. 29.

[28] AAUW, *Gender Gaps*, pp. 36–41.

[29] NCES, *The Condition of Education 1998*, p. 91. NCES also has noted that boys spend more time than girls participating in math- and science-related activities, while girls spend more time on math and science homework. U.S. Department of Education, National Center for Education Statistics, *Findings from the Condition of Education 1997: Women in Mathematics and Science*, no. 11, NCES 97-982 (September 1997), p. 10 (hereafter cited as NCES, *Women in Mathematics and Science*). The fact that girls spend more time on homework may explain their better grades in math and science. However, that boys are more likely than girls to use computers and calculators at home, participate in science clubs, talk to scientists, and conduct their own science experiments, suggests that different exposure to science translates into gender differences in math and science later on in life.

[30] AAUW, *Gender Gaps*, pp. 36–41.

[31] Ibid., pp. 13–14.

these fields has decreased since the mid-1980s.[32]

- Although the percentage of medical degrees awarded to women increased from 9 to 38 percent between 1972 and 1994, women continue to earn fewer medical degrees than men.[33]
- Among women who had been recently hired as biology faculty in 1992, 60 percent were hired as part-time employees, and more than 75 percent were in nontenure track positions.[34]
- Women still lag behind men in engineering degrees, accounting for 11, 17, and 15 percent, respectively, of the bachelor's degrees, master's degrees, and doctoral degrees in engineering awarded in 1994.[35]
- Women account for 30 to 40 percent of the undergraduate degrees in the geosciences, mathematics, and the physical sciences—the proportion of women receiving degrees in these fields decreases for master's degrees (ranging from 31 to 34 percent) and doctoral degrees (22 percent).[36]

The field in which one works and/or earns a college degree has a significant impact on one's future earnings potential and career path.[37] According to the National Center for Education Statistics (NCES) of the U.S. Department of Education:

> The mathematics skills of the Nation's workers may be a crucial component of its economic competitiveness. In an increasingly technological world, knowledge of mathematics is critical for success in scientific and engineering occupations. It is also essential for those working in the growing number of diverse occupations that use computers as a foundation for their other activities, such as graphic designers, librarians, and business managers.[38]

However, girls tend to focus on a smaller set of career options, with the result that women "are seriously underrepresented in the higher paid, higher prestige, and better paying occupations, such as high level managers (i.e., CEO's), medical specialties involving surgery, the physical sciences and technical occupations."[39]

There are many benefits associated with taking advanced mathematics and science courses. According to a 1997 DOEd report, taking rigorous mathematics and science courses has benefits for the job market as well as college.[40] Many 4-year colleges require 3 to 4 years of high school mathematics courses for admission, and math skills will be increasingly important to obtaining well-paying jobs in the future. In the job market, those with strong math and science backgrounds are more likely to be employed and earn more money than those with less math and science experience, even if they have not gone to college. The report also noted that a shortage of workers skilled in math and science could affect U.S. performance in global markets.[41]

According to the DOEd report, many jobs that once required little background in math and science now require skill in algebra, geometry, and statistics.[42] Jobs such as photographer, financial manager, budget analyst, optometrist, roofer, dental hygienist, surveyor, tool and dye maker, and surgical technologist all require at least a high school level of math and science courses. Five jobs requiring math and science skills are among the fastest growing occupations: computer scientist, systems analyst, occupational therapy assistant and aide, medical assistant, and physical therapist.[43] As the Secretary of Education stated at the 1998 conference of the American Mathematical Society and the Mathematical Association of America:

---

[32] National Science Foundation, *Women & Science: Celebrating Achievements, Charting Challenges*, March 1997, p. 10.

[33] DOEd, *Title IX: 25 Years of Progress*.

[34] National Science Foundation, *Women & Science*, p. 6.

[35] Ibid., p. 15.

[36] Ibid., pp. 20, 25.

[37] NCES, *Women in Mathematics and Science*, p. 16.

[38] NCES, *The Condition of Education 1998*. NCES says much the same regarding science: "Competence in science is an important outcome of education. The ability to apply scientific information, interpret data, and make inferences about scientific findings is required in a world that relies heavily on technological and scientific advances. Aside from workplace requirements, scientific proficiency is crucial in understanding environmental, medical, economic, and other issues that confront modern societies." Ibid.

[39] Helen S. Farmer, "Gender Differences in Adolescent Career Exploration," *ERIC Digest*, Jan. 30, 1995.

[40] U.S. Department of Education, *Mathematics Equals Opportunity*, Oct. 20, 1997, p. 5.

[41] Ibid., pp. 13–14.

[42] Ibid., p. 15.

[43] Ibid.

Quite simply, a quality mathematics education *must* be an integral part of today's learning experience. In order to succeed in our information based society, students must have a solid understanding of the basics—reading, science, history, the arts—and, smack at the center of this base of essential knowledge—must be mathematics.

. . .

It should come as no surprise then that almost 90 percent of new jobs require more than a high school level of literacy and math skills. An entry level automobile worker, for instance, according to an industry-wide standard, needs to be able to apply formulas from algebra and physics to properly wire the electrical circuits of a car.[44]

Moreover, a June 1999 report of the Department of Education found that advanced-level mathematics courses have the "strongest continuing influence on bachelor's degree completion."[45] Taking courses beyond algebra II more than doubles the odds that a student will complete a bachelor's degree.[46] According to the Secretary of Education, "[t]oday's students must master high-level mathematical concepts and complex approaches to solving problems to be prepared for college, careers of the 21st century, and the demands of everyday life."[47]

The U.S. Commission on Civil Rights has addressed Title IX enforcement and the civil rights issues enforcement agencies such as the U.S. Department of Education seek to resolve. For example, in 1976, the Commission issued a guide to federal laws and regulations prohibiting sex discrimination.[48] In this report, the Commission published the Title IX regulations[49] and discussed the statute, including its coverage, nondiscrimination requirements, complaints filing, and enforcement and sanctions under the statute.[50] The following year, the Commission issued a report based on a title-by-title review and analysis of the U.S. Code, focusing on sex bias contained in its provisions.[51] The report, prepared by Columbia University law professors Ruth Bader Ginsberg and Brenda Feigen Fasteau, called upon Congress to remove or revise numerous provisions containing sex-biased references.

In 1980, the Commission issued two reports on Title IX. The first, titled *More Hurdles to Clear: Women and Girls in Competitive Athletics*, focused on girls' and women's participation in high school and college athletics programs.[52] The second, issued in October 1980, evaluated the Title IX enforcement efforts of the U.S. Department of Health, Education and Welfare.[53] It focused on data collection and analysis, complaints processing, compliance reviews, enforcement procedures, and technical assistance, outreach, and education.[54] The report found that the agency needed to improve its Title IX policy and procedural guidance to regional staff, allocate necessary staff resources to complete planned compliance reviews, and increase Title IX technical assistance and public information efforts.[55]

In 1996, the Commission released *Equal Educational Opportunity Project Series, Volume I*, a precursor to this report. Volume I examined the federal agency that now holds the primary responsibility for issues related to education, the Department of Education, and the office within the department responsible for civil rights mat-

---

[44] Richard W. Riley, Secretary, U.S. Department of Education, "The State of Mathematics Education: Building a Strong Foundation for the 21st Century," remarks at the conference of the American Mathematical Society and the Mathematical Association of America, Jan. 8, 1998, accessed at <http://www.ed.gov/inits/Speeches/01-1998/980108.html> on July 23, 1999.

[45] U.S. Department of Education, Office of Educational Research and Improvement, *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment*, June 1999, p. vii.

[46] Ibid., pp. vii, 16–18.

[47] Richard W. Riley, Secretary, U.S. Department of Education, Nov. 12, 1998, quoted in U.S. Department of Education, "America Counts," accessed at <http://www.ed.gov/inits/Math/index.html> on July 23, 1999.

[48] U.S. Commission on Civil Rights, *A Guide to Federal Laws and Regulations Prohibiting Sex Discrimination*, clearinghouse publication no. 46 (July 1976).

[49] *See* ibid., pp. 178–85.

[50] Ibid., pp. 76–82.

[51] U.S. Commission on Civil Rights, *Sex Bias in the U.S. Code*, April 1977.

[52] U.S. Commission on Civil Rights, *More Hurdles to Clear: Women and Girls in Competitive Athletics*, clearinghouse publication no. 63 (July 1980).

[53] U.S. Commission on Civil Rights, *Enforcing Title IX*, October 1980.

[54] *See generally* ibid.

[55] Ibid., pp. 34–42.

ters, the Office for Civil Rights (OCR). One of the issues addressed in volume I was the difficulty faced by female students in gaining equal access to advanced mathematics and science courses and the role of Title IX enforcement in ensuring such access. Among the Commission's findings, OCR had not developed sufficient policy guidance on Title IX enforcement issues. To address this deficiency, the report recommended that OCR "maintain a continuing effort to remain aware of the major judicial cases and education issues arising on . . . Title IX" and "make every effort to produce policy guidance or clarification where necessary."[56]

The report also recommended that in order to more effectively develop technical assistance and outreach and educational materials, OCR should expand the disciplines of the team members assigned to develop these materials.[57] In the case of Title IX enforcement in the academic setting, this would mean hiring or contracting with educators, sociologists, and other researchers doing work in the field of civil rights and sex discrimination in education.

With *Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX*, the Commission examines more closely federal enforcement of Title IX in the context of specific principles that advance equal educational opportunity and promote nondiscrimination. In keeping with the *Equal Educational Opportunity Project Series'* focus on within-school and within-classroom educational experiences, the Commission sought to identify principles crucial to promoting nondiscrimination and equal educational opportunity. Researchers have identified services and initiatives critical to the educational development and achievement of girls in public education. In addition, legislation and policies support equal educational opportunities for girls, recognizing an efficacy in educating all students. For example, Congress enacted the WEEA to encourage equal opportunities for girls at all levels of education, both public and private. Drawing on research, legislation, and policy, the Commission identified the following principles through which to examine enforcement of civil rights laws:

1. Structuring educational programs to serve a diverse student population by maintaining a primary objective to place students in regular classes and core academic curricula to the greatest extent possible; grouping students to reflect different abilities in various subjects; and reevaluating and regrouping students periodically to reflect different abilities in various subjects and changes in achievement, performance, and development.
2. Using neutral and nondiscriminatory diagnostic and screening procedures when placing students in educational programs.
3. Providing parental notification and ensuring that institutional programs facilitate and encourage the involvement of parents in their children's education.
4. Evaluating and allocating teachers, facilities, and other resources among educational programs.
5. Eliminating barriers, providing access to all subjects, activities, and career opportunities, and counseling each student to maximize his or her potential.

These principles are key components to structuring nondiscriminatory educational programs and advancing equal educational opportunity for all students. Congress incorporated these principles into civil rights laws and program statutes, such as Title IX and the Elementary and Secondary Education Act of 1965. Moreover, DOEd included many of the principles in its regulations and policies for Title IX and Title VI of the Civil Rights Act of 1964.[58] The Commission views these principles as crucial to ensuring nondiscrimination and promoting equal educational opportunity for all students. This report discusses how OCR, in its policies and case analyses, has approached Title IX for the five principles presented above as they relate to educational opportunities for girls in mathematics and science. It also assesses whether the approach is

---

[56] U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, December 1996, p. 258.

[57] Ibid., p. 262.

[58] *See generally* 34 C.F.R. pts. 104, 106 (1998); Michael L. Williams, Assistant Secretary for Civil Rights, Office for Civil Rights, U.S. Department of Education, memorandum to OCR Senior Staff, "Policy Update on Schools' Obligations Toward National Origin Minority Students with Limited-English Proficiency (LEP) Students," Sept. 27, 1991.

effective for ensuring nondiscrimination and equal educational opportunity.

In addition to discussing Title IX and OCR's work relating to that law, the report explores various educational practices and perspectives relating to girls in mathematics and science. It presents perspectives found in educational literature, social science studies, and federal law and policy. These perspectives are useful in explaining the significance of certain educational practices to Title IX compliance and to equal educational opportunity. They reveal certain problems or barriers that have resulted in limited educational opportunities for or discrimination against girls in mathematics and science. In addition, they provide a measure by which to determine whether OCR is using existing educational research in implementing, ensuring compliance with, and enforcing Title IX.

The Commission believes a primary concern in federally assisted educational programs should be the promotion of educational excellence for all students through guarantee of nondiscrimination and protection of students' rights under civil rights laws. A discussion of equal educational opportunity must thus incorporate a regard for education and for civil rights, equal opportunity, and equal access.

In presenting both civil rights and educational perspectives, this report acknowledges the relationship between educational practices and civil rights. To ensure fully that girls in mathematics and science receive an education in public schools that is nondiscriminatory and that affords equal educational opportunity, it is important to understand educational practices and how they influence educational opportunities for such students. In addition, to create effective civil rights regulations and policies, it is important to incorporate sound educational principles so that administrative provisions may serve as effective guidelines to nondiscriminatory educational practices. The Title IX regulations currently reflect that association between educational principles and civil rights.

By recommending new policy guidance, technical assistance, outreach, and education under Title IX, this report will help to ensure compliance with existing statutory, regulatory, and case law; assist in reducing barriers to equal educational opportunity for girls in advanced mathematics, science, and technology education; and ensure that the implementation and enforcement of Title IX respond to changes and innovations in existing educational practices or perspectives. Because this report presents educational and civil rights perspectives, it is not intended solely for the civil rights community.

The report informs parents and educators of (1) federal requirements and rights in public elementary and secondary education for girls; (2) barriers that limit the educational opportunities for girls in mathematics and science; and (3) practices that help to eliminate all forms of gender bias and ensure nondiscrimination in public educational programs and services. Consequently, in providing this information to parents, teachers, and administrators, this report will assist them in becoming more aware of problems limiting educational opportunities for girls in mathematics and science. It also will improve their ability to eliminate or reduce such barriers and ensure full compliance with Title IX's nondiscrimination provisions.

Although girls may no longer be denied access to math and science courses directly, significant barriers to math, science, and technology careers exist. Through lack of counseling; stereotypical socialization; discouragement; less aggressive inclusion of parents in designing programs; gender-biased teaching styles, resources, and testing; and other barriers, girls are steered from math, science, engineering, and other technical fields.[59] Careful review of such practices and technical assistance, outreach, and education concerning discrimination on the basis of sex are necessary to eliminate the gender gap in math, science, and technology (as well as in other fields).

---

[59] *See* chap. 2.

CHAPTER 2

Background

Historically, women have been denied educational opportunities, particularly in math and science.[1] Although the gender gap in mathematics and science has decreased over the years, differences remain. Educational experiences are shaped by numerous factors, including: socialization, teaching styles, counseling, teacher-student interaction, parental involvement, and peer influence. While not all of these factors can be measured or assessed, it is important to understand how they affect male and female students differently, and to recognize when such effects have disparate impacts, or result in inequitable treatment. It should be kept in mind that gender inequality can affect both boys and girls. While this report focuses on math, science, and technology, the U.S. Department of Education's Office for Civil Rights (DOEd/OCR), researchers, teachers, other school officials, and parents should be concerned with equal opportunity for all students. Further, according to one author:

> Whatever we do to enhance the attainment of women in science is most probably going to benefit men as well. We've already seen evidence that those changes that make women feel more comfortable in math and science—personal attention in a more collaborative atmosphere—help men as well.[2]

While the gender gap in education has decreased, several barriers to equal education for girls and women in advanced math, science, and technology remain. Such obstacles translate to few women entering careers in technological fields, which ultimately results in lower wages and limited career opportunities for women. Barriers in education are compounded by discrimination and harassment in the work force. Thus, ensuring equal opportunity in the nation's schools requires a careful evaluation not only of gender differences in grades, course taking, and skills, but also determining the effectiveness of the instruction, guidance, and encouragement students receive.

A HISTORICAL PERSPECTIVE: THE EDUCATION OF WOMEN IN AMERICA

The Effect of Attitudes about Women's Roles

In the early years of our nation's history, education and the careers it afforded were male domains.[3] During colonial times, women were considered "mentally and morally inferior" and were consigned to domestic work. In the post-revolutionary years, women's education was reserved primarily for those in the upper and middle classes and was an avenue "for an upwardly mobile marriage."[4] Women's roles were restricted during this period, and according to one historian:

> The model republican woman was to be self-reliant (within limits), literate, untempted by the frivolities of fashion. She had a responsibility to the political scene, though not to act on it. . . . But her competence did not extend to the making of political decisions.

[1] U.S. Department of Education (DOEd), Office for Civil Rights (OCR), "Equal Opportunity for Minorities and Women to Participate in Math and Science Courses," Mar. 29, 1993, p. 6.

[2] Sheila Tobias, "The 'Problem' of Women in Science: Why Is It So Difficult to Convince People that there is One?" pp. 150–59, in Association for Women in Science, *A Hand Up: Women Mentoring Women in Science*, 1993, p. 157.

[3] Myra Sadker and David Sadker, *Failing at Fairness: How Our Schools Cheat Girls* (New York: Simon & Schuster, 1994), p. 15.

[4] Linda K. Kerber, *Toward an Intellectual History of Women* (Chapel Hill: The University of North Carolina Press, 1997), p. 24.

Her political task was accomplished within the confines of her family. The model republican woman was a mother.

The Republican Mother's life was dedicated to the service of civic virtue; she educated her sons for it; she condemned and corrected her husband's lapses from it.[5]

Writing in England in the late 1790s, Mary Wollstonecraft, an early champion of women's rights, published *A Vindication of the Rights of Women*. In this landmark work that would have a lasting effect on American women, Wollstonecraft argued that the inadequate education of women furthered their oppression and limited women's roles in society.[6] Wollstonecraft's words foretold the experiences of women for years to come:

The education of women has, of late, been more attended to than formerly; yet they are still reckoned the frivolous sex, and ridiculed or pitied by the writers who endeavour by satire or instruction to improve them. It is acknowledged that they spend many of the first years of their lives in acquiring a smattering of accomplishments; meanwhile strength of body and mind are sacrificed to libertine notions of beauty, to the desire of establishing themselves—the only way women can rise in the world—by marriage.[7]

Even as the 20th century dawned, such attitudes persisted. Educational programs held limited opportunities for women. Male-only schools and institutions of higher education continued to flourish. Indeed, several professions were reserved for men only, including law, medicine, and engineering.[8]

Concepts of motherhood and family have long defined women and their roles in society. Social status and racial and ethnic identity also have implications for career and educational opportunities. The roles white women play in family settings, educational institutions, and employment often differ from the roles of African American women, Hispanic women, Asian American women, Native American women, and other women of color. For example, after the Civil War white women reportedly were compelled into careers in education because of "boredom" associated with their middle- and upper-class lifestyles.[9] African American women entered the teaching professions because they felt a duty to educate members of their community.[10] Indeed, "traditional" models of work and family, which describe white women's experiences, have never explained successfully the experiences of women of color.[11] Authors have suggested that in the African American community women's roles were different from women's roles in the white community.[12] For example, African American women held jobs that essentially were the same as the types of jobs held by men, particularly during the post-Civil War period.[13] According to one author, African American women have always played an important role in the financial aspects of the family:

Historically, the classic pattern of employment for African-American men and women has been higher-paying yet less secure work for Black men as contrasted with lower-paying, more plentiful work for Black women.[14]

Differences in attitudes toward work and family affected the education of women in different classes and racial and ethnic groups. According to one author, education holds different meanings for different racial and ethnic groups, noting a "deep-seated commitment to learning"

---

[5] Kerber, *Toward an Intellectual History of Women*, p. 58.

[6] Mary Wollstonecraft, *A Vindication of the Rights of Woman* (London: Joseph Johnson, 1792, reprinted by Dover Publications, Inc., 1996), pp. 1–3. *See* Kerber, *Toward An Intellectual History of Women*, pp. 34–35; Nancy F. Cott, ed., *Root of Bitterness: Documents of the Social History of American Women* (New York: E.P. Dutton & Co., 1972), pp. 8–10; Sue Headlee and Margery Elfin, *The Cost of Being Female* (Westport, CT: Praeger Publishers, 1996), pp. 169–71; Inez Haynes Irwin, *Angels and Amazons: A Hundred Years of American Women* (New York: Arno Press, 1974), p. 82.

[7] Wollstonecraft, *A Vindication of the Rights of Women*, p. 9.

[8] Diana Furchtgott-Roth and Christine Stolba, *Women's Figures: The Economic Progress of Women in America* (Arlington, VA: Independent Women's Forum and the American Enterprise Institute, 1996), p. 15.

[9] Patricia Hill Collins, *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment* (New York: Routledge, Chapman and Hall, Inc., 1991), pp. 150–51.

[10] Ibid.

[11] Ibid., pp. 46–48, 116–17.

[12] *See* U.S. Commission on Civil Rights, *The Economic Status of Black Women: An Exploratory Investigation*, staff report, October 1990, pp. 10–11.

[13] Collins, *Black Feminist Thought*, p. 49. *See also* Cott, *Root of Bitterness*, pp. 21–24.

[14] Collins, *Black Feminist Thought*, p. 59.

that has always been an integral part of African American families.[15]

The Evolution of Education for Women

During the colonial period, the education of women was inconsistent, and formal institutions of higher education for women were nonexistent. There was little encouragement of women's education beyond reading and writing, and literacy was primarily reserved for white women.[16] Boys and girls were segregated in schools, with girls receiving less instruction and less-qualified teachers.[17]

By the early 18th century, many states had developed educational programs for women; unfortunately many of the programs were based on the belief that "a woman's place was still in the home," and that women were the primary "caregivers" in the family.[18] As a result, the educational programs that were developed for women were most often designed to enhance their domestic skills, which would allow them to perform better in their roles as wives and mothers.[19] The few educational programs that women were allowed to participate in provided them with limited opportunities to develop their intellectual abilities, or skills that could be used outside the home.[20] Often, such barriers as excessive fees and irregularly scheduled hours presented additional obstacles to education for women.[21] For example, in some schools, girls were required to attend classes in the evening, but only after the boys had finished a full day in school.[22]

One of the first high school programs for girls was established in Boston, Massachusetts, in the first part of the 19th century.[23] Many large well-financed school districts, such as Boston, built separate schools for boys and girls, while smaller districts with less financing chose to implement dual systems within a single school.[24] Dual systems would require girls and boys to attend single-sex classes for the entire day. Single-sex classes also were taught by teachers who were the same sex as the students they taught. Girls and boys were often required to enter the school building through separate doors.[25]

In dual systems, girls and boys were sometimes given different courses. For instance, a traditional male curriculum would consist of classical studies in literature, history, and math and science. Girls would be offered more basic courses such as English, religion, and etiquette.[26] Eventually, many school districts chose coed schools over separate male and female schools because of their financial limitations.[27] Further, girls were taught by less-educated teachers than boys and would be provided inferior resources. A critic during the 19th century stated:

> We first keep their minds and then their persons in subjection. . . . We educate women from infancy to marriage, in such a way as to debilitate both their corporeal and their mental powers. All the accomplishments we teach them are directed not to their future benefit in life but to the amusement of the male sex; and having for a series of years, with much assiduity, and sometimes at much expense, incapacitated them for any serious occupation, we say that they are not fit to govern themselves.[28]

In 1819, Emma Willard wrote her *Plan for Improving Female Education*. Concerned that societal prejudice denied girls an appropriate education, particularly in math and science, Willard asked the New York State Legislature for funds to open a school for girls.[29] When the state refused to fund the school, citizens in Troy,

---

[15] Andrew Billingsley, *Climbing Jacob's Ladder: The Enduring Legacy of African-American Families* (New York: Simon & Schuster, 1992), pp. 172–74.

[16] Kerber, *Toward An Intellectual History of Women*, p. 229.

[17] Headlee and Elfin, *The Cost of Being Female*, p. 68.

[18] Sadker and Sadker, *Failing at Fairness*, p. 17.

[19] Ibid.

[20] Ibid.; Marlaine E. Lockheed, with Susan S. Klein, *Sex Equity in Classroom Organization: Handbook for Achieving Sex Equity Through Education* (Baltimore: The Johns Hopkins University Press, 1991), p. 189 (hereafter cited as Lockheed and Klein, *Handbook for Achieving Sex Equity Through Education*).

[21] Lockheed and Klein, *Handbook for Achieving Sex Equity Through Education*, p. 6.

[22] Sadker and Sadker, *Failing at Fairness*, p. 16.

[23] Ibid., p. 17.

[24] Ibid.

[25] Ibid. *See also* Kerber, *Toward An Intellectual History of Women*, pp. 28–32.

[26] Sadker and Sadker, *Failing at Fairness*, p. 17.

[27] Ibid.

[28] Thomas Cooper, quoted in Kerber, *Toward An Intellectual History of Women*, p. 29.

[29] Phyllis Stock, *Better Than Rubies: A History of Women's Education* (New York: Capricorn Books, 1978), p. 184.

New York, provided the funding to open the Troy Female Seminary in 1821. The school's curriculum included math, science, and domestic science.[30]

In 1833, Oberlin College was opened to women. Although the college offered somewhat different programs for women and men and whites and blacks, it "created the first coeducational and interracial student body and made an important statement about the range of people in whom genius might be found."[31] By the end of the 19th century, education had become almost completely coeducational at the elementary and secondary levels, as well as in higher education.[32] However, Oberlin College remained one of the few institutions of higher education that admitted black women.[33]

Despite the growth of coeducation, many educators believed that children could not be educated successfully in such an environment, citing different and distinct career paths, and the need for strict supervision as justification for sex segregation.[34] Others embraced the idea of coeducation, arguing that the presence of girls would "refine boys' rough behavior," and due to the better curricula offered in boys classes, girls in turn would receive better educations.[35] Many parents were uncomfortable with the idea of sending their daughters to school with boys, and women in general were not content with the limited educational and career opportunities provided to them in sex-segregated schools. This led to women developing their own educational institutions in the form of all-girls seminaries and academies.[36] However, the all-girls schools also limited career options. Seminaries did, however, recognize the importance of developing the intellectual abilities of women. Some seminaries offered more complete curriculums than those offered in public schools, and many included mathematics and science courses in their curriculums. However, most of these institutions still emphasized domestic skills, and continued to prepare women for traditional roles as wives and mothers.[37]

Despite the emergence of coeducation and all-girls seminaries and academies, the powerful influence of societal values on educational programs dictated that girls continue to gravitate toward domestic courses, such as home economics, typing, and reading and writing courses. According to two authors:

> [Female seminaries] provided protected education environments, safe havens for high-school-age girls to learn to become fit companions for their husbands, the first teachers of their children, and the moral and spiritual cornerstone of the family. These seminaries were dedicated to the tricky proposition of expanding women's educational options while keeping their role in life limited.[38]

Stereotypes and discrimination were often blatant. For example, critics in the late 1800s argued that education, particularly coeducation, could affect the reproductive health of females.[39]

Nonetheless, by the turn of the century, girls outnumbered boys in secondary education, with boys often abandoning high school for employment.[40] Between 1900 and 1920, women increased their enrollment in colleges and universities from one-third of the student body to one-half of the student body, resulting in women being perceived as a threat to the male domain of education.[41]

The 20th century movement of women into the labor force had a significant effect on women's education. During World War I and the Depression era in the 1930s, many women began to work outside the home.[42] The following decade brought the cathartic changes of World War II, when more women than ever before found jobs outside the home. While hundreds of thousands

---

[30] Ibid.

[31] Kerber, *Toward An Intellectual History of Women*, p. 230.

[32] Mary Moore, Valarie Piper, and Elizabeth Schaefer, Mathematica Policy Research, Inc., *Single-Sex Schooling: Perspectives From Practice and Research*, for U.S. Department of Education, Office of Educational Research and Improvement, vol. 1 (December 1993), p. 7.

[33] Kerber, *Toward An Intellectual History of Women*, p. 230.

[34] Moore, Piper, and Schaefer, *Single-Sex Schooling*, p. 7.

[35] Ibid.

[36] Sadker and Sadker, *Failing at Fairness*, p. 17.

[37] Ibid., p. 19; Donna B. Jeffe, "About Girls' 'Difficulties' in Science: A Social, Not a Personal, Matter," *Teachers College Record*, vol. 97, no. 2 (1995) p. 209.

[38] Sadker and Sadker, *Failing at Fairness*, p. 19.

[39] Ibid., p. 30. *See also* Stock, *Better Than Rubies*, p. 191.

[40] Stock, *Better Than Rubies*, p. 222.

[41] Kerber, *Toward An Intellectual History of Women*, p. 231.

[42] Committee on the College Student, Group for the Advancement of Psychiatry, *The Educated Woman: Prospects and Problems* (New York: Charles Scribner's Sons, 1975) pp. 28–31; Stock, *Better Than Rubies*, pp. 214–15.

of men fought in the war, women worked in the factories that produced war-time goods. These factories, left vacant by men who had been drafted, provided women with steady employment during the war years.[43] Women also entered higher education in large numbers during the war.[44]

Even though women were welcomed in colleges and universities during World War II, when men returned to higher education after the war, women were again treated with hostility.[45] After the war, women were expected to return to the home. As the birthrate grew, the number of women in the labor force and in higher education declined.[46] Between 1940 and 1950, the number of women earning college degrees declined from 41 to 14 percent.[47]

For minorities, however, the changes in educational opportunity were not as pronounced. Although officially desegregated in 1954, schools for African American children remained segregated and/or inferior to predominately white schools.[48] Throughout the later part of the 20th century discrimination continued in the nation's schools.[49] Further, despite the passage of Title IX and other civil rights legislation related to education, women and minorities continue to have unequal access to many educational programs.[50]

[43] Committee on the College Student, *The Educated Women*, p. 28.

[44] Stock, *Better Than Rubies*, pp. 222–23.

[45] Kerber, *Toward An Intellectual History of Women*, p. 232.

[46] Stock, *Better Than Rubies*, p. 224.

[47] Ibid., p. 226.

[48] *See* U.S. Commission on Civil Rights, *Twenty Years After Brown: The Shadows of the Past*, June 1974, pp. 8–17.

[49] *See, e.g.*, U.S. Commission on Civil Rights, Florida Advisory Committee, *Report on Panama City*, April 1964, pp. 1, 4; U.S. Commission on Civil Rights, Arkansas Advisory Committee, *Employment, Education, and Voting*, November 1966, pp. 6–9; U.S. Commission on Civil Rights, California Advisory Committee, *Educational Neglect of Mexican American Students in the Lucia Mar Unified School District, Pismo Beach, California*, January 1973; U.S. Commission on Civil Rights, California Advisory Committee, *The Schools of Guadalupe . . . A Legacy of Educational Oppression*, April 1973; U.S. Commission on Civil Rights, Iowa Advisory Committee, *Racial Problems in Fort Dodge, Iowa*, March 1974, pp. 6–17.

[50] *See* U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, December 1996.

Post-Civil Rights Era Initiatives to Improve Educational Opportunities for Women

Title IX of the Education Amendments of 1972

The civil rights movement of the 1960s infused further momentum into the women's rights movement. For example, Title VII of the Civil Rights Act of 1964[51] added significantly to the quest for equality in employment for women. However, the act did not contain any provisions related to education for women, and therefore did not offer relief for the inequalities faced by girls and women in public elementary, secondary, and postsecondary education.

Although women continued to face barriers in education that would later deny them access to professions and careers that had been exclusively for men, women's civil rights were advanced significantly in the context of education with the passage of Title IX of the Education Amendments of 1972.[52] The legislative history indicates that Congress enacted Title IX in part as a response to testimony concerning widespread discrimination against women in higher education.[53] Chaired by Representative Edith Green of Oregon, the hearings were held in conjunction with Congress' consideration of Section 805 of H.R. 16,098, a bill that would have added the word "sex" to Section 601 of the Civil Rights Act of 1964.[54] Known as Title VI, this provision prohibits discrimination on the basis of race, color, and national origin in federally assisted programs, including housing, education, health services, and state and local governments.

The testimony on higher education focused on sex discrimination in educational institutions. For example, in his introduction of Title IX on the Senate floor, Senator Birch Bayh, the bill's sponsor, emphasized the seriousness of gender discrimination in medical school admissions.[55] Senator Bayh stated that from 1966 to 1967, only 18 out of 89 medical schools had student enrollments in which more than 10 percent of

[51] Pub. L. No. 88-352, tit. VII, § 701, 78 Stat. 253 (codified as amended at 42 U.S.C. §§ 2000e–2000e-17 (1994)).

[52] 20 U.S.C. §§ 1681–1688 (1994).

[53] *See Discrimination Against Women: Hearings on § 805 of H.R. 16,098 Before the Special Subcommittee on Education of the House Committee on Education and Labor*, 91st Cong., 2d Sess. (1970) (hereafter cited as *1970 House Hearings*).

[54] Pub. L. No. 88-352, 78 Stat. 252 (codified as amended at 42 U.S.C. §§ 2000d–2000d-7 (1994)).

[55] 118 Cong. Rec. 5803 (statement of Senator Bayh).

the students were female.[56] Moreover, Mr. Bayh introduced statistics demonstrating that although the percentage of female applicants to medical schools increased more than 300 percent between 1929 and 1965, the percentage of those that were accepted actually declined from 65.5 percent in 1929 to 47.7 percent in 1965.[57]

Sponsors of the legislation, known as Title IX, sought to accommodate members of Congress opposed to a comprehensive prohibition against sex discrimination in all federally assisted programs, including those at elementary, secondary, and higher education levels.[58] The language of Title IX was patterned after that of Title VI but limited in scope to educational institutions and in coverage to sex discrimination. The resulting civil rights statute states that "[n]o person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance. . . ."[59]

In 1975, the Commission stated that the U.S. Department of Health, Education and Welfare (HEW) had accomplished little to enforce Title IX, stating that HEW's delay in publishing final Title IX regulations "effectively nullified the intent of Congress" with regard to Title IX.[60] In a 1980 report, the Commission found that by 1979, HEW had failed to develop clear policies and had devoted insufficient resources to conduct compliance reviews and complaint investigations.[61] However, Title IX recently has been touted by educational experts as having had a substantial impact on equal opportunity for women and girls in education.

Women's Educational Equity Act

Two years after the enactment of Title IX, Congress enacted the Women's Educational Equity Act (WEEA),[62] noting that educational programs in the United States "are frequently inequitable as [they] relate to women and frequently limit the full participation of all individuals in American society."[63] Originally, the WEEA amended the Elementary and Secondary Education Act of 1965.[64] In 1994, when Congress reauthorized the Elementary and Secondary Education Act as the Improving America's Schools Act,[65] the WEAA, now Title V of the Improving America's Schools Act,[66] included the finding that "teaching and learning practices in the United States are frequently inequitable as such practices related to women and girls."[67] In particular, Congress noted:

> [G]irls do not take as many mathematics and science courses as boys, girls lose confidence in their mathematics and science ability as girls move through adolescence, and there are few women role models in the sciences . . .[68]

The WEEA also notes:

> [C]lassroom textbooks and other educational materials do not sufficiently reflect the experiences, achievements, or concerns of women and, in most cases, are not written by women or persons of color . . .[69]

---

[56] Ibid.

[57] Ibid. (Senator Bayh, citing statistics from *The Journal of Medical Education*, vol. 42, no. 1 (January 1967) and *The Association of Medical Colleges Datagram*, vol. 7, no. 8 (1966)).

[58] *See* 117 Cong. Rec. 30, 407, 30, 408 (1971); 118 Cong Rec. 5803, 5807, 18, 437 (1972) (remarks of Senator Bayh); 117 Cong. Rec. 39, 256 (1971) (remarks of Representative Green).

[59] 20 U.S.C. § 1681(a) (1994). *See also* American Association of University Women (AAUW), *Creating Gender-Fair Federal Education Policy*, p. 1.

[60] U.S. Commission on Civil Rights, *The Federal Civil Rights Enforcement Effort—1974*, vol. III, *To Ensure Equal Educational Opportunity*, 1975, p. 41.

[61] U.S. Commission on Civil Rights, *Enforcing Title IX*, October 1980, pp. 4–5.

[62] Pub. L. No. 93-380, tit. IV, pt. B, § 408, 88 Stat. 554 (codified as amended at 20 U.S.C. §§ 7231–7238 (1994 & Supp. III 1997)).

[63] Pub. L. No. 93-380, tit. IV, pt. B, § 408(b)(1), 88 Stat. 554, 555.

[64] Pub. L. 89-10, 79 Stat. 27 (codified as amended in scattered sections of 20 U.S.C.).

[65] Pub. L. 103-382, 108 Stat. 3519 (codified as amended at 20 U.S.C. §§ 6301–8962 (1994 & Supp. III 1997)). For more information on the Elementary and Secondary Schools Act and the Improving America's Schools Act, *see* U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, December 1996, pp. 14–16, 22–23.

[66] Pub. L. 103-382, tit. V, pt. B, § 5201, 108 Stat. 3695 (codified as amended at 20 U.S.C. §§ 7231–7238 (1994 & Supp. III 1997)).

[67] 20 U.S.C. § 7231(B)(3) (1994).

[68] *Id.* § 7231(B)(3)(C) (1994).

[69] *Id.* § 7231(B)(3)(B) (1994).

The WEEA is aimed exclusively at gender equity issues in education. The act sought to provide educational equity for women in the United States and financial assistance to enable educational agencies and institutions to meet the requirements of Title IX.[70] An additional purpose of the act is "to promote equity in education for women and girls who suffer from multiple forms of discrimination based on sex, race, ethnic origin, limited-English proficiency, disability, or age."[71] In particular, the WEEA specifies that the Secretary of Education shall establish priorities for funding, which can include projects to develop new educational training, counseling, or other programs designed to increase the interest and participation of women in mathematics, science, and computer science courses, or to enhance their skills in those areas.[72] The WEEA allows the U.S. Department of Education to fund grants to develop model equity programs and fund the implementation of equity programs in schools throughout the country.[73] The WEEA authorizes support and technical assistance programs for such activities as:

- Assisting educational agencies and institutions in implementing policies and practices to comply with Title IX.
- Training teachers, counselors, administrators, and other school personnel, especially preschool and elementary school personnel, in gender-equitable teaching and learning practices.
- Providing leadership training for women and girls to develop professional and marketable skills to compete in the global marketplace, improve self-esteem, and benefit from exposure to positive role models.
- Enhancing educational and career opportunities for those women and girls who suffer multiple forms of discrimination, based on sex and on race, ethnic origin, limited English proficiency, disability, socioeconomic status, or age.
- Evaluating exemplary model programs to assess the ability of such programs to advance educational equity for women and girls.
- Introducing into the classroom textbooks, curricula, and other materials designed to achieve equity for women and girls.
- Using nondiscriminatory tests of aptitude and achievement and alternative assessments that eliminate biased assessment instruments from use.[74]

THE CURRENT STATUS OF WOMEN AND GIRLS IN MATH, SCIENCE, AND TECHNOLOGY

In 1997, the National Coalition for Women and Girls in Education issued a "report card" on Title IX, concluding that "there is no question that Title IX has had a significant impact on women and girls."[75] However, on a variety of measures, the coalition awarded grades no higher than a "B-minus." In the areas of math and science, the coalition awarded the grade of "C," which indicated that "more improvement is necessary."[76] The report concluded that although more girls are taking math and science classes, gender differences remain, especially as students progress through their educational careers. By the time they reach college, women's participation rates in math and science classes decrease.[77] The coalition concluded that some of this drop may be due to "the hostile environment [women] encounter in these fields."[78]

The coalition's report also found that sex segregation persisted in other areas of education, such as vocational education where "men are clustered in high-skill, high-wage job tracks; women in the low-wage, traditionally female tracks."[79] Similarly, the classroom learning environment also received a low grade.[80] The report noted:

> Females frequently receive better report card grades, perhaps in part for their quiet and agreeable behav-

---

[70] *Id.* § 7232(1)-(2) (1994).

[71] *Id.* § 7232(3) (1994).

[72] *See* 34 C.F.R. §§ 246.11(b), 247.11(c) (1998).

[73] 20 U.S.C. § 7233(b)(1)(A)-(B) (1994). *See also* U.S. Department of Education, Office of Elementary and Secondary Education, *Application For Grants Under Women's Educational Equity Act Program*, ED Form 436-1.

[74] 20 U.S.C. § 7233(b)(2)(A)(i)-(iii)

[75] National Coalition for Women and Girls in Education, *Title IX at 25: Report Card on Gender Equity*, 1997, p. 1.

[76] Ibid., p. 4.

[77] Ibid., p. 29.

[78] Ibid., p. 30.

[79] Ibid., p. 17.

[80] Ibid., p. 24.

iors. Males on the other hand, who are socialized to be active and aggressive, find that these same behaviors in the classroom are unacceptable. Thus, males, particularly males of color, get disciplined more often and more harshly. Paradoxically, this better behavior by females frees the teacher to focus upon males, not only for discipline, but for instruction as well. The result is that boys benefit with more chances to answer, demonstrate knowledge, and think critically. Just as in the case of higher education, teachers in elementary and secondary schools provide males with more frequent and more precise feedback, including acceptance, praise, criticism, and remediation, all of which promote and direct their achievement.[81]

In 1997, the Department of Education also issued a report describing the progress the United States had made in the 25 years since the passage of Title IX. The report noted that since the 1970s, more women enroll in and graduate from college and earn graduate and professional degrees in areas previously dominated by men, such as medicine, dentistry, and law.[82] In its 1997 report, DOEd also noted that more women are participating in math and science courses and athletics than ever before.[83] However, the report noted several trends that inhibit educational and occupational opportunity for women:

- Sexual harassment in schools.
- Women's lower number of degrees in computer science, engineering, physical sciences, and mathematics compared with men.
- Fewer high school varsity teams and fewer college athletic scholarships for girls than for boys.
- Underrepresentation of women in jobs in scientific fields.
- Lower earnings of women compared with men.[84]

Despite some gains, throughout the 1990s, women remained underrepresented in many math, science, and technology fields; received fewer science and engineering degrees than men; and remained concentrated in largely "female" occupations. Stereotypes about gender roles persist, affecting the experiences girls and women have in the educational setting. Historical discrimination in the educational context has been compounded by discrimination in the workplace, translating to unequal wages and limited career opportunities. Taken together, these factors influence the career paths of both men and women, and have repercussions for the labor force and the competitiveness of the United States as a nation.

Elementary and Secondary Schools

Gender differences in math, science, and technology experiences are minimal or nonexistent at the elementary school level, but appear to grow as students progress through high school.[85] At the elementary and middle school levels, boys and girls participate in mathematics and science instruction equally, and standardized test data indicate that their mathematics and science achievement levels are similar, although boys' average scores on standardized mathematics and science tests slightly exceed those of girls in fourth and eighth grade. This is true for several states and in some cases nationally.[86]

Although girls lagged behind boys in mathematics and science course enrollment as recently as the early 1980s, in the 1990s, girls and boys had similar overall patterns of mathematics and science course enrollment and grades at the high school level with the exception of advanced mathematics, science, and computer courses.[87] At least the first 2 years of high school mathematics and science are taken in the same proportions by girls and boys. However, girls continue to lag behind boys in enrollment in the most advanced mathematics and science courses, as well as on advanced placement tests in those subjects.

As a followup to its 1990 report, the American Association of University Women released a second report in 1998.[88] The report noted that girls

---

[81] Ibid., p. 25.

[82] U.S. Department of Education, *Title IX: 25 Years of Progress*, June 1997, p. 2.

[83] Ibid., pp. 8, 11–13.

[84] Ibid., pp. 15–16.

[85] Valerie E. Lee, et al., *The Influence of School Climate on Gender Differences in the Achievement and Encouragement of Young Adolescents* (Washington, DC: American Association of University Women, 1996), p. 3. *See also* chap. 3.

[86] *See* National Science Foundation, *Women, Minorities, and Persons with Disabilities in Engineering: 1996*, pp. xviii, 10–11. *See also* chap. 3.

[87] *See* chap. 3.

[88] American Association of University Women, *Gender Gaps: Where Schools Still Fail Our Children*, 1998.

have made progress in the number and types of math and science courses they are taking, and continued to take more humanities courses, including language and fine arts classes, than boys.[89] The report stated that when course-taking patterns are viewed as a whole, "girls may be getting a broader education than boys by deepening their exposure to math and science and by enrolling in more courses in other subject areas."[90] Nonetheless, girls are found in fewer numbers than boys in advance math, science, and technology courses, such as calculus, physics, and computer engineering.[91]

Relying on National Center for Education Statistics data from 1994, the report concluded:

> Girls' failure to take more top math and science courses remains an obstinate problem, with a long-term impact. Data on college majors and degrees earned indicate that girls may not make the transition from high school math and science courses to advanced postsecondary courses in these fields. This failure threatens to make women bystanders in the burgeoning technology industry of the 21st century and keep women underrepresented in high-salaried, intellectually challenging engineering, biochemistry, and biotechnology careers.[92]

Colleges and Universities

Although women outnumber men in college enrollments and degree completion, gender disparities are found in the college majors men and women choose, and the degrees they receive.[93] As shown in table 2.1, women dominate men in the number of degrees received in the following fields: home economics; nursing, pharmacy, and health technologies; education; psychology; liberal arts and humanities; and social sciences.[94] Men are overwhelmingly represented in engineering; agriculture and forestry; law; medicine and dentistry; and physical and earth sciences. As recent research shows, test scores alone do not account for gender differences in choice of college major. According to two authors:

> Among the many factors that influence men's and women's choice of major, and consequently gender differences in careers and wages, three factors related to gender may be particularly important: a student's preparation and achievement at pre-collegiate levels of education, especially in mathematics; an individual's preferences for various courses of study, which may be encouraged by parental and societal expectations; and the labor market prospects associated with a given set of skills, which may provide more encouragement for one sex than the other to pursue certain fields of study.[95]

TABLE 2.1
Persons 18 and Over with a Bachelor's Degree or Higher, by Sex and Field of Study, 1993

Field of study	Female (%)	Male (%)
Engineering	12.8	87.2
Agriculture and forestry	19.7	80.5
Law	25.8	74.1
Medicine and dentistry	26.3	73.7
Physical and earth sciences	29.4	70.8
Vocational and technical studies	30.7	69.3
Police science and law enforcement	30.9	69.1
Economics	32.3	67.6
Business and management	32.9	67.1
Biology	36.5	63.5
Mathematics and statistics	36.6	63.3
Social sciences	56.3	43.7
Liberal arts and humanities	57.1	43.0
Psychology	60.4	39.6
English and journalism	61.7	38.3
Education	75.6	24.4
Nursing, pharmacy, and health technologies	83.7	16.3
Home economics	95.5	4.5

SOURCE: U.S. Department of Education Statistics, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), table 10.

In other words, decisions concerning field of study may be affected not only by individual preferences, but by socialization, parents, previous experiences, and expectations of future work prospects. Failure to gain the necessary skills at previous levels of education also influences one's career aspirations and occupational choices.[96]

[89] Ibid., p. 10.

[90] Ibid.

[91] Ibid., pp. 11, 13, 14, 23–24. *See also* chap. 3.

[92] Ibid., pp. 24–25.

[93] *See* chap. 3 for a more detailed discussion.

[94] DOEd, *Digest of Education Statistics: 1998*, table 10.

[95] Sarah E. Turner and William G. Bowen, "Choice of Major: The Changing (and Unchanging) Gender Gap," *Industrial and Labor Relations Review*, vol. 52 (January 1999), p. 289.

[96] Ibid.

Thus, it is vitally important to present children with numerous opportunities at young ages, and to provide them the encouragement needed to allow them to set high goals for themselves.

Math, Science, and Technology Careers

In the work force, women are underrepresented in engineering, computer science, and other technological fields. For example, women make up less than 30 percent of the computer science labor force.[97] In 1995, women were 35 percent of the postsecondary computer and mathematics teachers.[98] Of those employed in 1995 in computer and mathematical sciences, women made up 22 percent of the scientists and engineers in colleges and universities; 44 percent of those employed in other educational institutions; 27 percent of those in for-profit business or industry; 26 percent of those who are self-employed; 39 percent of those employed in the private not-for-profit sector; 22 percent of those employed in the Federal Government; and 36 percent of those employed in state or local governments.[99]

In addition, women are less likely than men to be in fields that command higher salaries, such as computer science.[100] With increasing age, the gender gap in salary widens.[101] In 1995, among computer and mathematical scientists with bachelor's degrees between the ages of 20 and 29, the median salary for men was $3,000 higher than the median salary for women. Among computer and mathematical scientists with bachelor's degrees between the ages of 40 and 49, the median salary for men was $9,000 higher than the median salary for women.[102] Some of this difference can be explained by the lesser prevalence of women in higher positions in academe and industry.[103]

Factors Affecting Girls' Participation in Advanced Math, Science, and Technology

There are several factors that can potentially affect girls' participation in advanced math and science. Socioeconomic status, family influences, resources, schools, peers, and individual attitudes and beliefs all influence educational outcomes.[104] Although opportunities for women in math and science have improved since the enactment of Title IX, barriers in the form of negative attitudes, stereotypes, lack of encouragement, discrimination, and harassment remain.[105]

Attitudes toward Math and Science

Gender differences in attitudes toward math, science, and technology persist. According to the U.S. Department of Education, students' perceptions about math and science influence achievement. Students who do well in math and science tend to have positive attitudes toward those subjects. In turn, when students have a positive attitude about a particular subject, they are more likely to take courses in those subjects and perform better than students with negative attitudes.[106] Similarly, participation in math- and science-related activities can also keep students interested in math and science classes.[107]

A number of studies have examined girls' and boys' attitudes toward and experiences in math and science. Although evidence from these studies is mixed, the studies generally indicate both boys and girls have positive attitudes toward mathematics and science during elementary school.[108] However, as they progress through school, a gender gap in interest, self-confidence, and aspirations in mathematics and science seems to emerge, with girls generally expressing less interest in mathematics and science, less confidence in their abilities in these

---

[97] National Science Foundation, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1998*, p. 100.

[98] Ibid., appendix, p. 291, table 5-1.

[99] Ibid., appendix, p. 297, table 5-7.

[100] Ibid., p. 105.

[101] Ibid.

[102] Ibid.

[103] Ibid.

[104] Sandra L. Hanson, *Lost Talent: Women in the Sciences* (Philadelphia: Temple University Press, 1996), pp. 14–18.

[105] *See* National Coalition for Girls and Women in Education, *Title IX at 25*.

[106] U.S. Department of Education, National Center for Education Statistics, *Findings from the Condition of Education 1997: Women in Mathematics and Science*, no. 11, NCES 97-982 (September 1997), p. 8 (hereafter cited as NCES, *Women in Mathematics and Science*).

[107] Ibid., p. 10.

[108] Ibid., p. 8. *See generally* Hanson, *Lost Talent*.

fields, and less interest in pursuing advanced high school or college majors in these subjects.[109]

There is a strong relationship between perceived mathematics and science skills and adolescents' sense of self-worth.[110] In a study conducted by the American Association of University Women (AAUW), researchers found that girls' perception of their abilities in mathematics and science was most strongly related to their self-esteem: as girls learned they were not excelling in these subjects, their sense of self-worth and aspirations tended to diminish.[111] The AAUW survey also found substantial differences in girls' and boys' perceptions of their abilities in mathematics. Approximately 31 percent of elementary school girls and 49 percent of their male peers reported they had an aptitude for mathematics.[112] By high school, only 15 percent of girls, compared with 25 percent of boys, thought they had talent in mathematics.[113] Similarly, a recent report on women in math and science by the National Science Foundation found:

> Several studies have demonstrated that young women receive higher grades than men in high school and college science and mathematics courses. Despite this, women tend to think that they are not performing well; the opposite is true with men. This lack of self-confidence (or overconfidence in the case of men) is carried throughout life.[114]

The percentages of boys and girls who state that they enjoy math and science also fall between elementary school and higher grades. During the elementary years, very similar proportions of girls and boys (81 and 84 percent, respectively), reported that they liked mathematics. By high school, however, girls' interest in mathematics drops more than does boys' interest. For instance, 61 percent and 72 percent of high school girls and boys, respectively, reported that they liked mathematics—a decline of 20 percentage points for girls, compared with 12 percentage points for boys.[115] Similar gender differences exist with respect to interest in science.[116]

Overall, a circular relationship exits among a positive attitude toward mathematics and science, self-esteem, and career aspirations.[117] According to the AAUW, "students who appreciate these subjects tend to possess higher self-esteem, and students with greater self-worth tend to have an affinity for mathematics and science endeavors."[118] In turn, these students are more likely to prefer careers in occupations that will utilize these subjects.[119] Thus, the AAUW identified girls' declining sense of abilities (accurate or

---

[109] American Association of University Women, *Shortchanging Girls, Shortchanging America: Executive Summary*, 1994, pp. 4, 6 (hereafter cited as AAUW, *Shortchanging Girls: Executive Summary*). In the fall of 1990, AAUW commissioned a national survey of almost 3,000 children (2,374 girls and 600 boys). The survey included 92 questions relating to children's self-esteem, educational experiences, interest in mathematics and science, and career aspirations. Reporting on this survey, AAUW related that there were substantial gender differences in these variables and that these differences expanded as children moved from elementary school to middle school and high school. Ibid. Another study, conducted by the Educational Testing Service, found gender differences in perceptions of mathematics talent increased as students progress through school. Ibid., p. 16 (citing J. Dossey et al., *The Mathematics Report Card*, 17-M-01 (Princeton, NJ: ETS, 1988)). *See also* NCES, *Women in Mathematics and Science*.

[110] AAUW, *Shortchanging Girls: Executive Summary*, p. 10.

[111] Ibid., p. 10. Girls could be underestimating their abilities in mathematics and science, since girls and boys participate at similar rates in most mathematics and science courses. *See* U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1996*, NCES 96-304 (June 1996); National Science Foundation, *Women, Minorities, and Persons with Disabilities in Science and Engineering*, pp. 9, 111, 112, 137; AAUW, *How Schools Shortchange Girls* (New York: Marlowe & Co., 1995), pp. 42–44.

[112] AAUW, *Shortchanging Girls: Executive Summary*, p. 11.

[113] Ibid.

[114] National Science Foundation, *Women & Science: Celebrating Achievements, Charting Challenges*, March 1997, p. 19.

[115] Ibid., p. 10.

[116] For both boys and girls, the decline in interest in science between the elementary and secondary school years was smaller than for mathematics. However, a gender disparity was still evident: 75 percent of elementary school girls, compared with 82 percent of boys reported that they liked science. By high school, there was a 12 percentage point decline (to 63 percent) in the share of females who expressed a liking for science, compared with only a 7 percentage point reduction (to 75 percent) among boys. The percentage of students with positive attitudes toward science declined more between elementary school and high school for girls (21 percentage points) than for boys (7 percentage points). Ibid., pp. 10–12.

[117] AAUW, *Shortchanging Girls: Executive Summary*, pp. 12, 16.

[118] Ibid., p. 12.

[119] Ibid.

not) during adolescence as a critical educational concern.[120]

Boys and girls also have different attitudes toward technology. According to one author, boys and girls interact differently with technology. For example:

> Girls use technology as a way to connect with people and solve real-life problems, whereas boys view technology as a way to extend their power, preferring computerized games and entertainment that build upon competition and contest. Males also find the workings of the technology itself as enthralling as the uses of technology.[121]

Differential interest and participation in math, science, and technological endeavors ultimately results in disparities in career options and lifetime earnings. Boys are encouraged to enter lucrative, growing fields such as engineering and computer science. Girls are not encouraged equally.[122] Such disparities could be diminished through stronger enforcement of Title IX, including improved technical assistance, outreach, and education.

Socialization and Stereotypes

A 1999 television advertisement campaign for a hospital showed a little girl with stomach pains. After undergoing numerous tests and seeing several specialists, it was discovered that the cause of her pain was algebra. The advertisement campaign was criticized for perpetuating a negative stereotype of girls' ability (or inability) to cope with mathematics. Although eventually the hospital stopped showing the commercial, it planned to conduct focus groups to determine whether the advertisement should be used.[123] Unfortunately, much of society is the same way—only after much thought and consultation does it realize the pervasiveness of the negative stereotypes it perpetuates, often too late to reverse the consequences.

According to the Department of Education, girls and boys differ in their career aspirations as early as the eighth grade.[124] Through socialization, children learn how society expects them to behave and interact with others. Parents, teachers, peers, and media are among the primary agents of socialization. For example, parents who allow their sons more freedom than their daughters teach boys to be adventurous and independent, while girls learn the importance of staying at home.[125] Further, although girls often have scientific aspirations at young ages, as they mature they often are socialized into traditional female roles. Gender-role socialization and gender-specific stereotypes teach children that certain occupations are not open to them and, for example, that girls are not capable of becoming engineers.[126] Often unconsciously, society encourages children to adhere to stereotypical roles and internalize negative views about gender, race, and ethnicity. Boys are encouraged to learn about abstract concepts in math and science and play with action toys, and are rewarded for aggressive behavior; girls are taught to be passive and caring and to express themselves orally and in writing.[127]

---

[120] Ibid., p. 7. The AAUW survey's results with respect to students' attitudes toward science are supported by the 1990 National Assessment of Educational Progress (NAEP) Science Proficiency Assessment, which asked students at three grade levels (4th, 8th, and 11th grades) to respond to a basic attitudinal question: "Do you like science?" At the fourth-grade level, girls and boys seemed to have equal liking for science: approximately 80 percent of students (78 percent of girls and 81 percent of boys) responded affirmatively. NCES, *The 1990 Science Report Card*, pp. 80–81. However, older children's responses were consistent with the AAUW survey's findings. Interest in science fell for students of both genders, but fell more for girls. By eighth grade, a significantly higher proportion of male (72 percent) than female (64 percent) NAEP participants responded that they liked science. By 11th grade, only 57 percent of girls reported that they liked science—a substantially lower percentage than the 74 percent of their male counterparts. Ibid.

[121] Steve M. Dorman, "Technology and the Gender Gap," *Journal of School Health*, vol. 68, no. 4 (April 1998), p. 165.

[122] Julia Steiny, "Edwatch: Women Overcoming Job Barriers—Yo, girls! Listen Up!" *The Providence Journal-Bulletin*, Apr. 5, 1998, p. 1H.

[123] Judy Mann, "The Children Get It, Why Not Children's?" *The Washington Post*, Mar. 10, 1999, p. C14.

[124] NCES, *Women in Mathematics and Science*, p. 11.

[125] Doris R. Entwisle, Karl L. Alexander, and Linda Steffel Olson, *Children, Schools, and Inequality* (Boulder, CO: Westview Press, 1997), pp. 137–39.

[126] Susan A. Ambrose, *Journey of Women in Science and Engineering: No Universal Constants* (Philadelphia: Temple University Press, 1997), p. 24 (hereafter cited as Ambrose, *No Universal Constants*).

[127] Katherine Hanson, "Teaching Mathematics Effectively and Equitably to Females," Center for Equity and Cultural Diversity Working Paper 1 (Newton, MA: Education Development Center, Inc., 1992), pp. 8, 13–15. *See also* WEEA Publishing Center, *Gender-Fair Math* (Newton, MA: Education Development Center, Inc., 1995), p. 2; Bridget Murray, "Boys to Men: Emotional Miseducation," *APA Monitor On-*

The National Science Foundation noted that the many negative stereotypes of women in science continue to pervade our society and negatively affect girls' perceptions of their own abilities and interests. These stereotypes are reinforced in schools and continue into college and careers. NSF states:

> Girls often receive subtle feedback from parents, teachers, friends, and the community that steers them away from the sciences, especially engineering. Some young women receive the message that there is a mismatch between being feminine and pursuing interests in technical areas.[128]

Researchers have noted that the labeling of certain areas and occupations as "male," such as science, math, and engineering, affects interest in and exposure to those areas.[129] A brochure developed by the WEEA publishing center notes that gender-role stereotyping causes girls to take courses other than math and science, beginning in middle school.[130] According to the brochure:

> Math anxiety and technophobia are learned responses that begin at home. We are taught stereotypes by our families, the media, teachers, peers, and textbooks. As girls reach adolescence, the stereotype about math being only for males is one of the powerful barriers that prevents many girls from becoming interested in mathematics.[131]

Researchers note that "[m]any factors conspire to encourage girls and women to believe that science and engineering are not appropriate fields for them, and to sabotage their confidence in their ability to succeed at science and mathematics."[132] Parents, teachers, counselors, peers, the media, and other people and institutions aid in the socialization of children, which often results in socialization into stereotypical gender roles. According to one author:

> In the process of growing up we imagine ourselves as medical doctors healing the sick, astronauts walking on the moon, and inventors on the cutting edge of technology. We are captivated by movies and television shows with scientific themes. Whereas the realities of everyday life constrain our thinking, science offers us endless possibilities. Science invites us to dream. For girls, this is at the level of a true fantasy because there are few visible examples of successful women scientists. Boys, however, grow up surrounded by men in positions of authority and leadership, which instills within them a sense of entitlement that is largely absent for girls. Thus, for boys, the dream is not a fantasy; it is solidly within their grasp.[133]

In a study of self-esteem and self-evaluations of confidence, a team of researchers found that as girls grow older, they tend to hold more stereotypic attitudes.[134] Peer pressure magnifies negative stereotypes about appropriate behavior for girls. Not wishing to be viewed as assertive, unfeminine, or "studious," adolescent girls often mask their intelligence and engage in activities in which girls are expected to participate. A DOEd brochure on encouraging girls in math and science stated that high school girls who consider themselves to be good in math tend to see math as a male-dominated field and view mathematicians and scientists as " 'nerds,' 'social outcasts,' and 'loners.' "[135] Thus, the girls who do challenge stereotypes and participate in math and science endeavors face multiple barriers "entering the stigmatized culture of nerds, and then being an oddity among her fellow nerds because of gender."[136]

Boys, too, are limited in their choices because of socialization:

> At a time when girls are questioning the status quo and revising old rules, schoolboys seem locked in the past. From leisure activities to courses and career

---

line, vol. 30, no. 7 (July/August 1999), accessed at <http://www.apa.org/monitor/julaug99/youth.html>.

[128] National Science Foundation, *Women & Science: Celebrating Achievements*, March 1997, pp. 48–49.

[129] Susan A. Basow and Lisa R. Rubin, "Gender Influences on Adolescent Development," pp. 25–52, in Norine G. Johnson, Michael C. Roberts, and Judith Worell, *Beyond Appearance: A New Look at Adolescent Girls* (Washington, DC: American Psychological Association, 1999), p. 37.

[130] WEEA Publishing Center, *Gender-Fair Math*, p. 3.

[131] Ibid., p. 2.

[132] Ambrose, *No Universal Constants*, pp. 25–26.

[133] Angela M. Pattatucci, ed., *Women in Science: Meeting Career Challenges* (Thousand Oaks, CA: Sage Publications, 1998), pp. 1–2.

[134] Jacquelyn Eccles, Bonnie Barber, Deborah Jozefowicz, Oksana Malenchuk, and Mina Vida, "Self-Evaluations of Competence, Task Values, and Self-Esteem," pp. 53–83, in Johnson, Roberts, and Worell, *Beyond Appearance*, p. 55.

[135] U.S. Department of Education, Office of Educational Research and Improvement, *Working Together, Making Changes: Working in and out of School to Encourage Girls in Math and Science*, by Patricia B. Campbell, 1992, p. 5.

[136] Gerhard Sonnert, *Who Succeeds in Science? The Gender Dimension* (New Brunswick, NJ: Rutgers University Press, 1995), p. 5.

planning, inflexible codes channel them into rigidly defined roles.[137]

Such rigidly defined roles may have a negative effect on a boy's educational progress. For example, one study found that boys who are encouraged to undertake traditional male roles, such as participating in sports, are likely to experience few rewards from access to mathematics and science classes. However, boys (and girls) who are introduced to nontraditional activities, such as cheerleading (or varsity sports for girls), experience achievement in other areas as well.[138] Similarly, girls who are exposed to less traditional attitudes toward women's roles have higher self-esteem and, consequently, higher achievement in nontraditionally female pursuits, such as math, science, and technology.[139]

Although gender stereotypes have become less inflexible, historical assumptions, such as "math is not for girls" and "women should not reveal their intelligence," continue to have an effect on women's achievement and interest in math and science.[140] One researcher stated:

> Throughout their learning girls are encouraged to be passive, caring, to take no risks, and to defer to male voices in the public discussion. They are also given the message that math is for males. Such an orientation obviously has an impact on how they learn and behave in school.[141]

Further, women are socialized to avoid risk, which may be a source of their unwillingness to participate in discussions on math and science concepts or to learn new technology. In addition, math, science, and technology careers may be seen as "risky business for females."[142]

Additionally, many assume that women cannot handle the competitive nature of science and technology occupations.[143] According to one author, women who attempt to enter math and science careers "are silenced at each point along the scientific career track" and/or feel that they have to be "spectacular just to be considered average."[144] According to this author, women who remain in math and science occupations learn to be unobtrusive, acquiescent, and submissive.[145]

However, many professional women, especially those in mathematics and science fields, report strong encouragement from parents, teachers, and other role models.[146] Other women in math and science fields report having had a nontraditional or gender-neutral upbringing.[147] This suggests that exposure to new ideas and activities can broaden women's experiences and open doors to new opportunities.[148] Indeed, the experiences of women in competitive sports, higher education, and nontraditional fields suggest that, given equal opportunity, women can contribute to and excel in such areas.

Self-Esteem

Between 1997 and 1999, the American Association of University Women conducted "Sister-to-Sister Summits" with adolescent girls, focusing on school and societal issues facing girls today. Among the most pressing issues were "image and appearance" and low self-esteem.[149] The girls in the AAUW summits cited gender-role stereotyping, racism, sexism, media images, and lack of teacher and peer support as sources of low self-esteem.[150] Inability to live up to socie-

---

[137] Sadker and Sadker, *Failing at Fairness*, p. 203.

[138] *See* Sandra L. Hanson and Rebecca S. Kraus, "Women, Sports, and Science: Do Female Athletes Have an Advantage?" *Sociology of Education*, vol. 71 (1998), pp. 93–110.

[139] Basow and Rubin, "Gender Influences on Adolescent Development," pp. 36–37.

[140] Wendy Schwartz and Katherine Hanson, "Equal Mathematics Education for Female Students," *ERIC/CUE Digest*, no. 78 (February 1992); Hanson, "Teaching Mathematics," p. 11.

[141] Hanson, "Teaching Mathematics," p. 8.

[142] Ibid., p. 13.

[143] Ambrose, *No Universal Constants*, p. xii.

[144] Pattatucci, *Women in Science*, pp. 16–17.

[145] Ibid., p. 18.

[146] Ambrose, *No Universal Constants*, p. xviii.

[147] Pattatucci, *Women in Science*, p. xii; Hanson, *Lost Talent*; T.E. Smith, "Gender Differences in Science Achievement of Adolescents: Effects of Age and Parental Separation," *Social Forces*, vol. 71 (1992), pp. 469–84; J. Oakes, "Opportunities, Achievement, and Choice: Women and Minority Students in Science and Mathematics," chap. 3, in C.B. Cazden, ed., *Review of Research in Education*, vol. 3 (Washington, DC: the American Educational Research Association, 1990).

[148] Hanson and Kraus, "Women, Sports, and Science," pp. 93–110; Sandra L. Hanson and Rebecca S. Kraus, "Women in Male Domains: Sport and Science," *Journal of Sport Sociology*, vol. 16 (1999), pp. 92–110.

[149] American Association of University Women, *Voices of A Generation: Teenage Girls on Sex, School, and Self*, 1999, p. 9.

[150] *See generally* ibid.

tal expectations not only leads to a low self-image, but trying to meet unrealistic expectations steers girls away from endeavors that they feel society does not wish them to undertake. As stated by one summit participant, "[girls] shouldn't have to change to fit what other people want."[151] Yet, for the most part, they feel they have to adapt to others' expectations.

In a study of female students in a college-level mathematics methodology course for education majors, a researcher found that a recurring theme in discussions with the subjects was "how, in relation to mathematics, their self-worth had become diminished over the years, how particular teachers had shattered self-confidence, and how lack of success had destroyed their self-esteem."[152] Several authors have noted that a lack of confidence and self-esteem is caused by, and at the same time hinders, performance in math and science classes.[153] According to one author:

> One of the most troubling features of dysfunctional attitudes toward mathematics is the loss of self-esteem. Embedded in [a female student's] comment, "Who wants to feel stupid *all* of the time?", are feelings of helplessness and despair. While it must be acknowledged that some gains have been made in helping women feel more confident and comfortable in the field of mathematics, we are still a long way from removing the well-established classroom barriers and practices, as well as the societal biases which make it impossible for female students to function on an equal footing with their male colleagues.[154]

The AAUW and other researchers have found that, by the time they reached adolescence, girls have low self-esteem and self-confidence in their abilities in mathematics and science. This is attributed to girls' lesser participation in advanced mathematics and science and to treatment received by girls and boys in school.[155]

Research has shown that self-esteem decreases for both boys and girls between elementary and middle school. However, the decrease is larger for girls.[156] According to the AAUW, physical changes associated with adolescence are linked to changes in self-esteem. Boys view such changes as positive—they are growing bigger and stronger. Girls, however, view such changes as negative, "reinforcing their declining self-esteem and gender stereotypes."[157] The AAUW also reported other research that appears to indicate that girls tend to have higher expectations of failure and lower self-confidence when encountering novel academic situations than do similarly qualified boys.[158] Furthermore, girls are more likely to attribute their successes to luck, whereas boys tend to credit their abilities.[159]

Other studies have suggested that self-esteem is lower for women than for men in col-

---

[151] Ibid., p. 7.

[152] Olive Fullerton, "Who Wants to Feel Stupid *All* of the Time?" in Pat Rogers and Gabriele Kaiser, eds., *Equity in Mathematics Education: Influences of Feminism and Culture* (Washington, DC: The Falmer Press, 1995), pp. 44–45.

[153] Fullerton, "Who Wants to Feel Stupid?" pp. 44–45; Lynn Friedman, "Assisting Women to Complete Graduate Degrees," chap. 5, in Pat Rogers and Gabriele Kaiser, eds., *Equity in Mathematics Education: Influences of Feminism and Culture* (Washington, DC: The Falmer Press, 1995).

[154] Fullerton, "Who Wants to Feel Stupid?" p. 37.

[155] AAUW, *Shortchanging Girls: Executive Summary*; American Association of University Women and Center for Research on Women at Wellesley College, *How Schools Shortchange Girls: The AAUW Report* (New York: Marlowe & Co., 1992), pp. 40, 42. *See also* Eccles et al., "Self-Evaluations of Competence, Task Values, and Self-Esteem," p. 69.

[156] AAUW, *Shortchanging Girls: Executive Summary*, p. 7.

[157] Ibid., p. 8. According to AAUW, the survey results indicated girls had lower self-esteem than boys. At the elementary school level, 67 percent of girls and 60 percent of boys reported they were always happy with themselves. AAUW, *Shortchanging Girls: Executive Summary*, p. 7. During the middle school years, only 37 percent of girls, compared with 56 percent of boys, agreed with this statement. By high school, only 29 percent of girls, in comparison to about 46 percent of boys, reported they were always happy with themselves. Thus, the gender gap in percentages of children with high self-esteem, as indicated by their answer to the question whether they were always happy with themselves, widened during the K–12 years, from 7 to 17 percentage points. Ibid., p. 121. *See also* Sadker and Sadker, *Failing at Fairness*, pp. 78–79.

[158] AAUW, *How Schools Shortchange Girls*, p. 121 (citing E. Maccoby and C. Jacklin, *The Psychology of Sex Differences* (Stanford, CA: Stanford University Press, 1974)).

[159] Ibid. However, AAUW's conclusion has been questioned by other researchers, who have criticized AAUW for not releasing the full study with the evidence on which they base their conclusion and for conducting "advocacy research." The concept of self-esteem appears to be more difficult to define and measure than implied in the AAUW report. *See* Christina Hoff Sommers, *Who Stole Feminism? How Women Have Betrayed Women* (New York: Touchstone, 1994), pp. 137–56.

lege and graduate school as well. One author cited several studies that found that despite similar grades, female students had lower self-estimates of their intelligence and self-worth.[160] According to this author, studies conducted at Stanford University and the Massachusetts Institute of Technology found that men and women have different perceptions of themselves and their abilities. These studies also found that compared with white males, female, foreign, and minority students are affected more by feelings of powerlessness, pressure, and isolation.[161]

As self-esteem decreases, so does students' confidence in their abilities. As confidence in their math abilities decreases, girls are less likely to enjoy math. According to the AAUW, both boys and girls who like math and science have greater self-esteem than students who report not liking math. Further, those who state that they like math and science are more likely to state that they want careers as doctors, scientists, and teachers. Thus, increased self-esteem and confidence are linked to career aspirations and outcomes.[162] Self-doubts and anxieties about academic performance can become "self-fulfilling prophecies."[163] Students' expectations that they will not do well in math or science may affect the grades they receive.[164] Lack of self-confidence may lead a student to overestimate the difficulty of certain classes, or lead to the conclusion that college is too difficult or competitive, further limiting his or her opportunities.[165]

Learning Styles

One explanation for girls' reported lack of interest in mathematics and science is that they may not perceive these subjects as relevant or meaningful to their lives.[166] The principles in math courses, in particular, often are not presented in a way that can be related to everyday life.[167] In addition, teaching styles often do not recognize gender differences in ways of learning and understanding.[168]

Certainly not all girls (or boys) learn in the same way, but researchers have suggested that generally boys and girls tend to learn differently.[169] Thus, if teaching styles are tailored to boys' ways of learning and understanding, girls may be adversely affected. For example, girls prefer a more conversational style, focusing on group consensus and the interrelationship of thoughts and actions. Comparatively, boys learn through argument and individual activity.[170] Nonetheless, many classroom situations encourage independent thinking, discussion of abstract concepts, dominance, and competition, thus devaluing other ways of learning that include mutual support, collaboration, and practical application of knowledge.[171] Teaching styles that employ a learning style other than a student's preferred way of learning cause the learning experience to be less enjoyable and less successful for that student.[172]

In January 1998, in a speech at the conference of the American Math Society and the American Mathematical Association, Secretary of Education Richard Riley offered the following suggestions to these associations' members for improving the quality of mathematics instruction:

- Make it a priority to prepare elementary and secondary school teachers to teach mathematics.
- Improve the curriculum and teaching methods used in undergraduate math courses.
- Create partnerships with colleges, universities, teachers, museums, technology centers, businesses, and other community institutions to "take advantage of the other learning resources that are out there and help students see new ways that mathematics

---

[160] Barbara Furin Sloat, "Perspectives on Women in the Sciences," pp. 194–204, in Deborah C. Fort, ed., *A Hand Up: Women Mentoring Women in Science* (Washington, DC: the Association for Women in Science, p. 1993), pp. 199–201.

[161] Ibid., pp. 199–200.

[162] AAUW, *Shortchanging Girls: Executive Summary*, p. 12.

[163] American Association of University Women Educational Foundation, *Gaining a Foothold: Women's Transitions Through Work and College*, 1999, p. 49 (hereafter cited as AAUW, *Women's Transitions*).

[164] Ibid.; WEEA Publishing Center, *Gender-Fair Math*, pp. 2–3.

[165] AAUW, *Women's Transitions*, p. 49.

[166] Fullerton, "Who Wants to Feel Stupid?" pp. 43–44; Schwartz and Hanson, "Equal Mathematics Education."

[167] Fullerton, "Who Wants to Feel Stupid?" pp. 43–44.

[168] *See* chaps. 5 and 7.

[169] *See* Schwartz and Hanson, "Equal Mathematics Education"; The Mid-Atlantic Equity Center (MAEC), *Beyond Title IX: Gender Equity Issues in School*, 1993.

[170] Schwartz and Hanson, "Equal Mathematics Education."

[171] Ibid.

[172] MAEC, *Beyond Title IX*.

and other learning is applicable to daily life."[173]

On the 30th anniversary of the landing of the Apollo 11 on the moon, Secretary Riley announced that former astronaut, John Glenn, would head the newly created National Commission on Mathematics and Science Teaching for the 21st Century. According to the Secretary:

> We know more clearly than ever today the critical role that taking challenging mathematics and science classes can have in the development of a young person's mind. From the earliest years of learning through high school, math and science classes are doorways to higher knowledge and future success.
>
> A student who is not taught the potential, meaning, and magic of mathematics and science is a student who is denied the opportunity of broader learning and exploration, whose dreams can go unfulfilled, and whose future is limited.
>
> But to learn and to appreciate these critical subjects, a student needs the wise guidance, strong hand, and nurturing qualities of a well-prepared and committed teacher.[174]

Counseling and Role Models

In a study of women who are working in science and engineering occupations, a researcher noted that the encouragement of parents, teachers, and mentors was crucial to their entering math and science fields.[175] Another author noted that "sensitive and accessible advising is crucial" for women's success in math and science fields.[176] As such, that author recommends that all students should have access to counseling and academic help on a regular basis, and that mathematics faculty should be available to provide such assistance.[177]

A 1994 poll conducted for the National Action Council for Minorities in Engineering suggested both middle school and high school girls believe they are more likely than their male counterparts to be encouraged to pursue advanced mathematics and science courses by parents, guardians, and other adults outside of school, as well as by teachers, guidance counselors, and other school personnel.[178] For instance, among 9th to 11th graders, 70 percent of girls and 68 percent of boys reported being encouraged by their parents to take more advanced mathematics and science classes; 64 percent of girls and 58 percent of boys were encouraged by their teachers; 52 percent of girls and 40 percent of boys were encouraged by their guidance counselors.[179]

However, other researchers have argued that women in science- and math-related graduate programs receive little support from colleagues, professors, mentors, and peers. One author cited several studies finding:

- Fewer women than men are research assistants.
- Female students have less prominent mentors than male students.
- There is less contact between male advisors and female students than between male advisors and male students.

---

[173] Richard W. Riley, Secretary, U.S. Department of Education, "The State of Mathematics Education: Building a Strong Foundation for the 21st Century," remarks at the conference of the American Mathematical Society and the Mathematical Association of America, Jan. 8, 1998, accessed at <http://www.ed.gov/inits/Speeches/01-1998/980108.html> on July 23, 1999.

[174] Richard W. Riley, Secretary, U.S. Department of Education, "Announcement of National Commission on Mathematics and Science Teaching for the 21st Century," July 20, 1999, accessed at <http://www.ed.gov/inits/Math/rileymathsp.html> on July 23, 1999.

[175] Ambrose, *No Universal Constants*, p. xviii.

[176] Friedman, "Assisting Women," p. 53.

[177] Ibid. *See* chap. 6.

[178] R. Leitman et al., "Uninformed Decisions: Survey of Children and Parents About Math and Science," *Research Letter*, vol. 5, no. 1 (New York: National Action Council for Minorities in Engineering, June 1995), p. 1. NACME commissioned a poll conducted by Louis Harris and Associates to establish baseline attitudes toward mathematics and science course taking. The poll asked various questions concerning students' general views of mathematics and science classes; students' intended participation in mathematics and science courses; individuals (e.g., peers, teachers, parents, other family members) who either discouraged or positively influenced the preadolescent and adolescent students to pursue mathematics or science opportunities; as well as students' perceptions of the relevance of mathematics and science courses to the students' futures. *See* National Action Council for Minorities in Engineering, *Uninformed Decisions: A Survey of Children and Parents About Math and Science* (New York: Louis Harris and Associates, 1994), pp. 259–60.

[179] Ibid., pp. 101, 106, tables 3-12, 3-17. Boys were more likely to find encouragement from sports coaches and, at the high school level, from the school principal. Ibid.

- Advisors have lower expectations for female students and are reluctant to criticize or provide feedback to women.
- Female students are not well integrated into the student network, are left out of social activities and social networks, and are not provided the informal skills necessary for success in scientific careers.[180]

Given barriers such as these, it is important to ensure that all students have equal access to appropriate education and career counseling and mentoring, and that the advice they receive is gender neutral and useful to them in making lifelong decisions.[181]

Discrimination and Sexual Harassment

Several authors have found that in addition to socialization, self-esteem, family, and other factors that can influence women's interest and participation in math and science, structural barriers also persist. Even when women have the educational resources to succeed, discrimination, sexual harassment, and stereotypes steer women away from math and science careers, or cause them to abandon such careers once they have embarked upon them.[182] Those who remain in math and science careers often feel isolated.[183]

A report by the Committee on Women in Science and Engineering of the National Research Council noted several barriers women face in science and engineering occupations:

> Limited access is the first hurdle faced by women seeking industrial jobs in science and engineering. While progress has been made in this area in recent years, common recruitment and hiring practices that make extensive use of traditional networks often overlook the available pool of women. Once on the job, many women find paternalism, sexual harassment, allegations of reverse discrimination, different standards for judging the work of men and women, lower salary relative to their male peers, inequitable job assignments, and other aspects of a male-oriented culture that are hostile to women. Women to a greater extent than men find limited opportunities for advancement, particularly for moving into management positions.[184]

Sexual harassment and discrimination also occur in the school setting. Sexual harassment in schools disproportionately affects girls, has a negative effect on students' educational experiences, and denies them equal educational opportunity.[185] Women may encounter sexual harassment in the form of hostility from male peers or male faculty at the college level.[186]

Sexual harassment and its psychological consequences may present barriers to equal participation in male-dominated classrooms and fields of study. Researchers have noted that the consequences of sexual harassment include decreased class participation, lower grades, and difficulty paying attention in class.[187] According to one legal commentator:

> Title IX regulations authorize affirmative action to overcome "the effects of conditions which resulted in limited participation" by women. It is necessary, therefore, to investigate the extent to which sexual harassment and assault limit the participation of women in campus life. In addressing this question, it is important, first, to understand the prevalence of sexual harassment and assault on college campuses, and second, to consider the extent to which these incidents affect women's participation in education.[188]

OCR has identified sexual and racial harassment as priority areas in its Strategic Plan and has produced technical assistance documents on these topics.[189] According to DOEd:

---

[180] Sonnert, *Who Succeeds in Science?* pp. 9–10.

[181] *See* chap. 5.

[182] Hanson, *Lost Talent*, pp. 18–19; Sonnert, *Who Succeeds in Science?* pp. 139–44; National Coalition for Women and Girls in Education, *Title IX at 25*, p. 31.

[183] Sloat, "Perspectives on Women in the Sciences," pp. 195–96.

[184] National Research Council, Office of Scientific and Engineering Personnel, Committee on Women in Science and Engineering, *Women Scientists and Engineers Employed in Industry: Why So Few?* (Washington, DC: National Academy Press, 1994), p. 1. *See also* ibid., pp. 17–49.

[185] MAEC, *Beyond Title IX*; National Coalition for Women and Girls in Education, *Title IX at 25*, pp. 30–34.

[186] Sonnert, *Who Succeeds in Science?* p. 8.

[187] Denise M. DeZolt and Mary Henning-Stout, "Adolescent Girls' Experiences in School and Community Settings," pp. 253–75, in Johnson, Roberts, and Worell, *Beyond Appearance*, p. 260.

[188] Fred von Lohmann, "Single-Sex Courses, Title IX, and Equal Protection: The Case for Self-Defense for Women," *Stanford Law Review*, vol. 48, p. 187.

[189] U.S. Department of Education, Office for Civil Rights, Strategic Plan, draft, Feb. 6, 1996, p. 2. *See* chap. 2 for a discussion of OCR's Strategic Plan. *See also* U.S. Department of Education, Office for Civil Rights, *Sexual Harass-*

Sexual harassment of students is a *real* and serious problem in education at all levels, including elementary and secondary schools as well as colleges and universities. It can affect any student, regardless of sex, race, or age. Sexual harassment can threaten a student's physical or emotional well-being, influence how well a student does in school, and make it difficult for a student to achieve his or her career goals.[190]

Thus, if, as research studies suggest, sexual harassment occurs in math, science, and technology education, OCR must focus on these areas to prevent the discouragement of girls from these crucial fields.

A Study of Gender Gaps in Two Contexts

There are a multitude of educational issues that can and should be investigated for the existence of "gender gaps." The perceived disinterest and underperformance by females in computer science and technology, and the perceived underachievement by males in reading, are areas currently mentioned in news reports and educational literature that require our attention. In this section, the Commission examines some of the latest research on these two topics.

Gender Gaps in Computer Science and Technology

In elementary and secondary schools, girls are not as likely as boys to participate in activities that promote the use of technology and computers, and are less likely to use computers as they grow older.[191] According to the National Science Foundation (NSF), "[g]irls with limited experience about technology, particularly information technologies, are at a disadvantage when they reach the undergraduate level and beyond."[192] In a statement concerning the Higher Education Act of 1998, Congresswoman Connie Morella noted: "While women are becoming more commonplace in the medical profession, they are still being nudged away from technology, from attitudes at colleges and universities to the cultures found in computer companies."[193]

While gender differences in mathematics and science participation and achievement have narrowed, the gender gap in technology continues to be significant. Software designed and marketed to target boys, boys' more extensive use of computers in and out of school, the disproportionate number of male candidates for higher education degrees in technology, and the notable difference in the number of males and females in technology-related fields perpetuate the idea that technology is exclusively for males. However, considering that computers themselves are not biased toward one gender, there is no reason why programs, education, and training cannot help to decrease the gender gap in technology.

Overall, schools have made much progress in incorporating technology into their programs. For example, the AAUW reports that 65 percent of public schools in the United States had Internet access in 1996.[194] However, reports suggest that girls "tend to have a more circumscribed, limited, and cautious interaction with technology than boys—both within and outside of school."[195] Girls tend to take data-entry and word-processing courses; few girls are found in computer programming and theory or graphic arts and computer-aided design classes—subjects that could lead to stimulating and high-income careers.[196]

The AAUW found that boys outnumber girls in computer science and computer design classes, and the gender gap widens from junior high to high school. The AAUW also noted that girls from all ethnic groups rate themselves lower on computer ability and have lower com-

---

ment: It's Not Academic, March 1998; U.S. Department of Education, Office for Civil Rights, and National Association of Attorneys General, *Protecting Students from Harassment and Hate Crime: A Guide for Schools*, January 1999.

[190] OCR, *Sexual Harassment*, p. 1.

[191] National Science Foundation, *Women & Science: Celebrating Achievements*, March 1997, p. 49; Dorman, "Technology and the Gender Gap," p. 165; Patty Henetz and Hilary Groutage, "Addressing Education's Education Gap," *The Salt Lake Tribune*, Oct. 17, 1998, p. A1. *See also* National Coalition for Women and Girls in Education, *Title IX at 25*, p. 30.

[192] National Science Foundation, *Women & Science, Celebrating Achievements*, p. 42.

[193] Connie Morella, Statement on the Higher Education Act of 1998, Congressional Press Releases, Federal Document Clearing House, Inc., Feb. 25, 1998.

[194] AAUW, *Gender Gaps*, Executive Summary, p. 4.

[195] AAUW, *Gender Gaps*, p. 99.

[196] Ibid., p. 14. *See also* Nancy Zirkin, chair, National Coalition for Women and Girls in Education, director of public policy and government relations, American Association of University Women, prepared statement before the Senate Health, Education, Labor and Pensions Committee, June 10, 1999, Federal Information Systems Corporation, Federal News Service.

puter self-confidence than do boys.[197] Similarly, the National Coalition for Women and Girls in Education noted that, although more girls are using computers, girls use computers less than boys, and computer clubs and contests are "overwhelmingly male."[198] Both the coalition and the AAUW note that there are few positive female role models or messages in computer games and software.[199] Such programs reinforce gender stereotypes and biases.[200]

Software: A Child's Introduction to Technology

Video and software games often function as a child's introduction to computer technology.[201] Nearly 85 percent of the revenues of the $12 billion technical toy and video game markets come from purchases by boys or for boys.[202] Relatively little software has been written with girls as a target market. Most of the software designed for girls seems to reinforce gender stereotypes of males as active and involved and females as passive and disengaged. In 1997, the National Coalition for Women and Girls in Education criticized the existing software for girls, stating: "Although software companies are now marketing to girls, the games often rely on sexist plots such as mall shopping and nabbing a boyfriend."[203] Many experts in the software industry agree that there is a lack of good software for girls, especially when it comes to offering the math and science instruction girls need to stay competitive.[204]

A growing number of studies report that boys and girls interact with technology differently. While boys want to "duel with the machine . . . girls like software that doesn't really have winners or losers, that gives them the opportunity to explore (one of the reasons they enjoy the Internet so much) and that has several solutions."[205] A 9-month poll of 1,200 families showed that, as girls grow, they use their personal computers "for word processing and to build learning skills, while boys use them mostly for games."[206] Girls view technology as a way to connect with others and solve real-life problems. In one study, when asked to imagine a futuristic invention, adolescent girls mentioned a type of computer that "could detect sadness and offer words of comfort" and a medallion "used to communicate with others and transport people at the press of a button."[207] Male participants in the same study viewed technology as an extension of their power: their inventions involved "absolute control, tremendous speed, and unlimited knowledge."[208] Additionally, unlike females, males found the workings of computers as interesting as the use of the devices.[209]

As a result of these different preferences, and a market that caters to the tastes of boys, girls may not find the software targeted at boys very interesting, possibly deterring girls from starting to use computers at a young age. Until recently, the male-dominated software industry had seen such incredible growth marketing only to boys that there seemed no reason to change its strategy.[210] However, with a decline in the growth rate in the industry, companies have started to look for new markets and audiences, including girls.[211] Unfortunately, the software often reflected the stereotypical ideas of what girls would be interested in while at the same time demonstrating the demand for girl-oriented software. For example, the success of the Barbie Fashion Designer CD-ROM in the mid-1990s proved to the software industry that a market for girls' products did indeed exist. A number of women have since decided to make sure there are good software products for girls on the mar-

---

[197] AAUW, *Gender Gaps*, Executive Summary, p. 4.

[198] National Coalition for Women and Girls in Education, *Title IX at 25*, p. 30.

[199] AAUW, *Gender Gaps*, Executive Summary, p. 4; National Coalition for Women and Girls in Education, *Title IX at 25*, p. 30.

[200] AAUW, *Gender Gaps*, Executive Summary, p. 4.

[201] Jane Swanson, "Opening a Market: Tech Toys for Girls," *Playthings*, December 1998, p. 68.

[202] Ibid., p. 68.

[203] National Coalition for Women and Girls in Education, *Title IX at 25*, p. 30.

[204] Ibid., p. 18.

[205] Knight-Ridder, "Software Designers Get with the Program—at Last, They're Discovering Girls," *The Buffalo News*, Nov. 9, 1997, p. 1E.

[206] Dottie Enrico, "Computer Use Declines as Girls Age," *USA Today*, Oct. 23, 1995, p. 1A.

[207] Debra Viadero "The Electronic Gender Gap," *Education Week*, Dec. 14, 1994, accessed at <http://www.edweek.org>.

[208] Ibid.

[209] Ibid.

[210] Knight-Ridder, "Software Designers Get with the Program."

[211] Ibid.

ket by becoming involved in the development and marketing of software.[212] The combination of these factors has led to an incipient increase in the number of software and Internet products targeted at girls between the ages of 6 and 16.[213]

Despite this increase in software for girls, many criticize the "fluff factor" and the potential for the reinforcement of stereotypes with the new programs.[214] HER Interactive received criticism for its focus on stereotypically "girlish" pastimes like boys, shopping, makeup, and dating; but their newest line offers girls interactive, more challenging mysteries "that appeal to girls' intellects with puzzles, problems, and brainteasers, and to their emotions through fostering care for the story characters."[215] For instance, Purple Moon, a publisher catering to girls in the 8- to 12-age range, offers software that deals with "feelings, friendships, families, and tough decisions—issues that the company's research says girls are interested in."[216] The newest line includes a "creativity component where girls can take matters into their own hands by making their own characters and adventures," and there is also a new line of products with adventures built around sports.[217] Without software that caters to females' preferences and styles of using computers, while at the same time avoiding the reinforcement of stereotypical gender roles and hobbies, the initial engagement of girls in technology will continue to be difficult.

Experiences with Technology

Out-of-School Experience. A 1984 study by the U.S. Department of Education showed that at that time, 17 percent of boys and 9 percent of girls used a computer at home.[218] In 1993, 27 percent of both boys and girls reported using a computer at home, but boys were twice as likely as girls to use computers daily.[219] In 1996, the Roper Youth Report found that 55 percent of 6- to 7-year-olds, 72 percent of 8- to 12-year-olds, and 67 percent of teenagers reported computer use during the previous 30 days.[220] Boys and girls reported using computers for an equal amount of time; however, boys were more likely to use computers at home, while girls were more likely to use computers only at school.[221] A 9-month study of 1,200 families done by FIND/SVP and Grunwald Associates found that girls actually spend more time than boys using computers at home until they reach the fourth grade.[222] The survey reported that between kindergarten and third grade, girls on average spent 1 hour more than boys each week on their home computers.[223] However, a change occurs in grades four to six, with girls' usage dropping and boys' usage increasing.[224] By the time they enter high school, girls spent 5.7 hours while boys spent 7.7 hours a week on the home computer.[225]

In addition to more computer use at home, boys also attend summer computer camps in greater numbers than girls; are more likely to have their own computers; play more video and computer games than girls; and are more likely to see themselves "depicted (as male main characters) in these games."[226]

In-School Experience. Though there have not been any national studies done, many small studies in lower-level education have shown obvious gender differences in advanced computer course enrollments, free-time use of computers, computer club membership, and computer contest participation.[227] One study, though done in 1985, still provides valuable insight into females' experiences with technology in middle school, considering that females continue to make up a small portion of computer classes today. The researcher noted that the high number of boys in these classes did not discourage females, but rather it was "the absence of their girlfriends"

---

[212] Ibid.

[213] Susan McLester, "Girls and Technology: What's the Story?" *Technology and Learning*, October 1998, p. 18.

[214] Ibid.

[215] Ibid.

[216] Ibid.

[217] Ibid.

[218] "Computing Computer Use by Girls," *St. Petersburg Times*, Mar. 6, 1996, p. 2D.

[219] Ibid.

[220] Dorman, "Technology and the Gender Gap," p. 165.

[221] Ibid.

[222] Enrico, "Computer Use Declines as Girls Age."

[223] Ibid.

[224] Ibid.

[225] Ibid.

[226] Cynthia Carter Ching et al., "Give Girls Some Space: Gender Equity in Collaborative Technology Activities," ERIC Publication ED419494 (1998), p. 3.

[227] Jo Sanders, "Girls and Technology: Villain Wanted in Teaching the Majority" (Teachers College Press, 1995), accessed at <http://www.cis.vt.edu/ws/wsmodules/science4.html>.

that kept them away from such classes, with "their need for same-sex peers at this age apparently extremely strong."[228] The researcher also reported that girls had said "their girlfriends' lack of computing was far more powerful in discouraging their computer use than any other factor."[229]

A study of the University of California at Los Angeles showed another obstacle girls face in computer classes. When 10- and 12-year-old boys and girls worked together in mixed teams on a technology project, boys "invested more energy in mastering technology, [while] girls were more concerned with orchestrating and organizing their groups."[230] The boys "tend[ed] to take over, often relegating girls to lower status tasks affording limited access to new technologies."[231] Other studies have found similar trends of young boys taking over collaborative efforts in technology projects: one researcher observed that boys often used more aggressive tactics to gain control, like grabbing the mouse, while girls used "noncontact methods," like verbal requests.[232]

In the *Digest of Education Statistics 1998*, the U.S. Department of Education found that both male and female high school graduates in 1994 received an average of 0.65 Carnegie units (one credit for the completion of a 1-year course) in computer science courses.[233] However, such statistics fail to reveal the types of computer courses males and females take. More male than female high school graduates in 1994 took full-year and half-year computer sciences courses and computer applications, while more females than males took clerical and data-entry classes—"the 1990s version of typing."[234] In 1998, 57 percent of the males and 43 percent of the females who took the SAT had had computer math courses in high school.[235] More males (55 percent) than females (45 percent) had taken computer programming, while more females (53 percent) than males (47 percent) had taken data processing.[236] More females (57 percent) than males (43 percent) had taken word processing, and more females (54 percent) than males (46 percent) had had no computer course work or experience.[237]

Only 18 percent of the students who took the Computer Science A and 12 percent of the students who took the Computer Science AB advanced placement (AP) exams were female.[238] Of all the math- and science-related AP exams, the computer science tests had the biggest gender gap in participation rates.[239]

The extensive use of computers in and out of school can have "a significant effect on students' attitudes and perceptions."[240] A survey of high school students showed that boys had higher ratings than girls on perceived competence with computers, positive attitudes toward computers, and perceived utility value of computers.[241] Such perceptions and attitudes, whether positive or negative, can have a serious effect on a student's decision for future studies and careers.

Computer Science and Technology Course Selection in Higher Education

Of the 40,560 SAT takers in 1998 who planned for advanced standing in college courses in computer science, 72 percent were male while only 28 percent were female.[242] Of the 48,625 students who planned to major in computer or information sciences once in college, 76 percent were male and 24 percent were female.[243]

---

[228] Ibid.

[229] Ibid.

[230] Ching et al., "Give Girls Some Space."

[231] McLester, "Girls and Technology: What's the Story?" p. 18.

[232] Ching et al., "Give Girls Some Space."

[233] U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, p. 150, table 136.

[234] AAUW, *Gender Gaps*, p.14. *See* U.S. Department of Education, National Center for Education Statistics, *Vocational Course Taking and Achievement: An Analysis of High School Transcripts and 1990 NAEP Assessment Score*, 1995.

[235] The College Board, "1998 Profile of College-Bound Seniors Report," accessed at <http://collegeboard.org/sat/cgsenior/yr1998>.

[236] Ibid.

[237] Ibid. *See* chap. 3, table 3.2.

[238] Educational Testing Services, facsimile to Monique Cueto, intern, U.S. Commission on Civil Rights, July 6, 1999. The Computer Science A exam covers one semester of college computer science material, while the Computer Science AB exam covers a full year of college computer science material.

[239] AAUW, *Gender Gaps*, p. 103. *See* chap. 3, table 3.8.

[240] Ching et al., "Give Girls Some Space."

[241] Ibid.

[242] *See* chap. 3, fig. 3.3.

[243] The College Board, *College-Bound Seniors 1998*. *See* chap. 3, fig. 3.4.

In 1995–1996, females earned roughly 27 percent of both bachelor's and master's degrees in computer and information sciences, and 15 percent of the doctorate degrees in this field.[244] White non-Hispanic, black non-Hispanic, Hispanic, Asian, and American Indian women each made up less than 15 percent of the total bachelor's, master's, and doctorate degrees in computer and information sciences conferred in 1995–1996.[245] Of all women in these groups, white non-Hispanic women received the highest percentage of each of these degrees. Over the last decade, women had increased their share of computer science doctorate degrees by one-third of a percent per year, and at this rate "women will achieve parity with men in 110 years."[246]

Improving Computer Education

With a software industry, computer classes from elementary school through higher education, and a work force completely dominated by males, yet another generation of females is growing up under the impression that technology is strictly for males. Technology experts are already pointing to warning signs of the decreased interest of females in the field. While computer use among boys and girls is equal at a young age, it is not long before boys begin to have more hands-on experience with technology in and out of school. By high school, boys are enrolled in more computer science courses than girls are, and in college, the gender gap in technology widens, with more bachelor's, master's, and doctorate degrees awarded to males in computer science fields.

Education and technology experts suggest several tips that can help girls get involved in technology:

- Train teachers to become sensitive to integrating gender-equitable computer use in classroom activities and to design lessons that highlight the contributions of women in math, science, and technology.
- Expose students to female mentors and role models in technology.
- Provide girls with opportunities for play and open-ended exploration on the computer.
- Encourage parents to be supportive of girls' computer use and interest in technology.
- Encourage girls' ownership of computers, which should lead to an increase in girls' use of computers at all levels.[247]

Indeed, there are examples of programs that can increase girls' and women's opportunities in technology fields. One case is the Computer Equity Expert Project 1, which ran from 1990 to 1993, providing 200 kindergarten through 12th-grade educators from every state with information about girls' avoidance of computing, math, and science, and training on how to change this.[248] In less than a year and a half, this program led to promising results:

- In New York, the ratio of girls to boys in the computer lab after school was 2:25 before the project. Now, it is 1:1.
- In Oregon, programming went from 23 percent female before the project to 35 percent after. Advanced programming went from 0 percent to 65 percent female.
- In Pennsylvania, female enrollment in several computer classes increased by more than 10 percent.
- In Kansas, female enrollment in advanced computer classes rose 134 percent.
- In Virginia, the AP Pascal class went from 0 percent to 50 percent female, and female membership in the computer club rose 30 percent.[249]

Despite the unfortunate past and precarious present of females in technology, programs that take extra steps to encourage young women to experiment with technology provide promising results and hope for the future.

Underachievement by Males in Reading

Although this report focuses on math, science, and technology, it should be noted that the gender disparities are not one sided. According to the 1998 report of the AAUW:

---

[244] U.S. Department of Education, National Center for Education Statistics *Digest of Education Statistics 1998*, table 253.

[245] Ibid., tables 265, 268, 271.

[246] Sanders, "Girls and Technology."

[247] Dorman, "Technology and the Gender Gap," p. 165; McLester, "Girls and Technology: What's the Story?" p. 18.

[248] Sanders, "Girls and Technology."

[249] Ibid.

Examining gender differences among boys and girls, across the curriculum, reflects of the goals of educational equity research, which attempts to document different educational outcomes according to factors such as sex, race, or class, regardless of which group these differences favor.[250]

Critics argue that too much emphasis has been placed on programs favoring boys over girls, or that boys are the ones who are now being "shortchanged" and "overlooked."[251] While boys and girls often have divergent interests, it is important that all students are offered opportunities to explore other concepts and learn new ideas. Equal opportunity and participation, for both boys and girls, must be supported through encouragement and the support of teachers, parents, counselors, and other role models and leaders.

There are some areas in which boys do not fare as well as girls. Statistics show that boys are more likely than girls to fail a course, repeat a grade, or drop out of school; boys and girls also differ in reading achievement.[252] In this case, it is the boys who continue to lag behind girls. Boys score below girls in reading and writing in the National Assessment of Educational Progress at all age levels.[253] For example, in 1996 the average score for reading achievement for boys at age 9 was 11 points lower than that of girls; at age 13, the score was 12 points lower for boys than for girls.[254] According to the National Research Council, numerous studies have found more boys than girls to be reading disabled; however, when samples that are more representative of the population are used, the ratio decreases.[255] Reasons for differences between girls and boys in reading and communication skills have included: physical maturity, inappropriate reading materials, negative treatment, differential treatment, and cultural factors.[256] However, the National Institute of Child Health and Human Development has noted:

[R]eading disability affects boys and girls at roughly the same rate. Reading disabled boys, however, are more likely to be referred for treatment, as they are more likely to get the teacher's attention by misbehaving. Reading disabled girls may escape the teacher's attention, as they may withdraw into quiet daydreaming.[257]

Other authors have noted that socialization and gender roles have an effect on boys' interest in reading. According to one review of the literature:

Early on in school, boys may begin associating reading as an activity that is inconsistent with the image of boyhood and maleness as it is stereotypically portrayed in the popular culture. Indeed there is evidence that this stereotype influences the perceptions and instruction of teachers, both male and female.[258]

To resolve this problem, researchers have suggested that teachers select books and teaching materials that provide positive male role models, as well as literature that appeals to and is relevant to the students.[259]

Critics argue, however, that "[g]irls suffer silent losses, but boys' problems are loud enough

---

[250] AAUW, *Gender Gaps*, p. 9.

[251] Laura Pappano, "The Gender Factor: In Our Efforts to Give Girls a Boost at School, Are We Creating New Problems—for Girls as Well as Boys?" *The Boston Globe*, Nov. 9, 1997, p. 25; Judith Kleinfeld, "Gender and Myth: Data About Student Performance," *Current*, no. 412 (May 1, 1999), p. 3; Judith Kleinfeld, "Student Performance: Males versus Females," *The Public Interest*, no. 134 (Jan. 1, 1999), p. 3.

[252] Sadker and Sadker, *Failing at Fairness*, p. 197; Entwisle et al., *Children, Schools, and Inequality*, pp. 122–23.

[253] U.S. Department of Education, National Center for Education Statistics, *The Condition of Education 1997*, June 1997, pp. 80, 82.

[254] Federal Interagency Forum on Child and Family Statistics, *America's Children: Key National Indicators of Well-Being*, 1998, p. 96.

[255] Catherine E. Snow, M. Susan Burns, and Peg Griffin, eds., "Committee on the Prevention of Reading Difficulties in Young Children, National Research Council, Preventing Reading Difficulties in Young Children" (Washington, DC: National Research Council, 1998), chap. 3, accessed at <http://www.nap.edu/readingroom/books/prydc/ch3.html>.

[256] Kathryn P. Scott, Carol Anne Dwyer, and Barbara Lieb-Brilhart, "Sex Equity in Reading and Communication Skills," chap. 14, in Susan S. Klein, ed., *Handbook for Achieving Sex Equity Through Education* (Baltimore: The Johns Hopkins University Press, 1985), p. 272.

[257] National Institute of Child Health and Human Development, "Why Children Succeed or Fail at Reading," accessed at <http://www.nih.gov/nichd/html/news/failatread/readbro.htm> on Nov. 18, 1998.

[258] William G. Brozo and Donald V. Schmelzer, "Wildmen, Warriors, and Lovers: Reaching Boys Through Archetypal Literature," *Journal of Adolescent & Adult Literacy*, vol. 41, no. 1 (September 1997), p. 5.

[259] Ibid., pp. 6–8; Linda Purty Carter, "Addressing the Needs of Reluctant Readers Through Sports Literature," *The Clearing House* (Helen Dwight Reid Educational Foundation), vol. 71, no. 5 (May 15, 1998), p. 309.

to be heard throughout the school."[260] In other words, the difficulties faced by boys in schools are "visible and public," so schools invest time and resources into addressing these issues.[261] This is because:

> Raised to be active, aggressive, and independent, boys enter schools that seem to want them to be quiet, passive, and conforming. In an uneasy compromise, many walk a tightrope between compliance and rebellion. To keep the balance, schools go the extra mile for males and give them more resources and attention. For some this isn't enough, however. They fail, are left behind, and never make it to graduation. Others become stars. They climb to the head of the class only to discover increasing pressure and the steep price of success.[262]

Inequality in the classroom, regardless of who is disadvantaged, should be of great concern to our nation. It is the responsibility of the Department of Education to investigate such disparities and eliminate all forms of gender bias in schools.

OCR's Challenge: Ensuring Nondiscrimination through Title IX

Although recent strides have been made, the struggle of women to attain equity in performance and participation in math, science, and technology is far from over. Disparities continue between males and females at the secondary school and college levels, as well as in the labor force. Several of the factors affecting performance and participation in advanced math, science, and technology, such as attitudes, stereotypes, socialization, and self-esteem, do not directly raise Title IX enforcement issues. However, Title IX jurisdiction, and thus OCR enforcement authority, may be indicated where federally funded educational programs treat males and females differently. Disparities in access to instructional materials or facilities, parental notification about curricular or extracurricular activities, counseling, and testing all potentially raise Title IX issues. As the enforcer of equal opportunity in education, OCR has the obligation to investigate thoroughly any such complaints, as well as any other circumstances in which males and females are treated differently under a federally funded educational program. Although the eradication of sex discrimination will not guarantee that males and females perform and participate at the same levels in math, science, and technology, OCR's enforcement of Title IX is a necessary term in the equal educational opportunity formula.

---

[260] Sadker and Sadker, *Failing at Fairness*, p. 197.

[261] Ibid.

[262] Ibid., p. 198.

CHAPTER 3

Trends in Mathematics, Science, and Technology Education and Subsequent Employment for Girls and Women

MATH AND SCIENCE PARTICIPATION AND ACHIEVEMENT IN ELEMENTARY AND SECONDARY SCHOOL: A GENDER COMPARISON

Gender differences in mathematics and science participation and achievement and course taking are minimal at the elementary school level, but grow as students progress through high school.[1] Differences between boys and girls in achievement and participation are significant because they may affect a student's interest in certain areas, which ultimately may affect career decisions and options. Further, differences in achievement and participation can be an indicator of unequal access to courses and/or school resources. In addition, group differences in course taking, grades, and other measures of access and achievement may indicate the existence of discrimination or may be the consequences of school policies, counseling, student-teacher interaction, or other educational experiences that are not intended to discriminate against certain students based on race, ethnicity, sex, or other factors but nonetheless have a disparate impact on certain groups.

Underrepresentation of girls in math and science courses in the elementary and secondary years will likely lead to a lack of interest in and underrepresentation in postsecondary math, science, and technology programs and careers. Somewhat lower enrollment in advanced math, science, and technology courses, and different experiences in those courses may cause the differences between boys' and girls' achievement on math and science achievement tests. Similar to underrepresentation of girls in advanced math, science, and technology courses, underrepresentation of females among the students with high achievement in math and science can ultimately affect careers and future wages.

Statistics on course participation and achievement are necessarily limited. With more than 58 million students in elementary and secondary schools, and almost 17 million students in institutions of higher education,[2] there is much ground to cover. The U.S. Department of Education (DOEd) conducts national surveys and studies of educational issues, including course taking and achievement.[3] However, statistics are only part of the story. Data on enrollment and outcomes can suggest patterns and trends in education, but cannot show exactly what is happening in terms of gender fairness and equal treatment of students. It is the responsibility of DOEd's Office for Civil Rights (OCR) to conduct a detailed, thorough, and careful analysis of how the nation's children, men, and women are educated to ensure equal access to education for all, particularly in areas that traditionally have been stereotypically male and female.

Enrollment in Math and Science Courses

Overall, boys and girls appear to exhibit similar course-taking patterns. However, boys continue to be found in greater proportions than girls in the technical computer, math, and sci-

[1] Valerie E. Lee et al., *The Influence of School Climate on Gender Differences in the Achievement and Engagement of Young Adolescents* (Washington, DC: American Association of University Women, 1996), p. 3.

[2] U.S. Department of Education, National Center for Education Statistics (NCES), *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 11, table 1 (hereafter cited as NCES, *1998 Digest*).

[3] *See generally* ibid.

ence classes, such as advanced placement (AP) courses in these fields in high school. While girls are well represented in algebra, geometry, and calculus courses, they lag behind boys in taking computer math, computer programming, and other advanced technology courses. Girls are, however, more likely than boys to take data processing and word processing—stereotypicallyfemale fields.

Elementary and Middle School

During elementary school, all students receive science and mathematics instruction together. Therefore, it is not possible to examine course-taking behavior at this level.[4] Middle school boys and girls, however, exhibit almost identical course-taking patterns. In 1992, middle school girls and boys had similar distributions among the various mathematics course options.[5] For instance, approximately 19 and 20 percent of girls and boys, respectively, were enrolled in algebra. Almost 50 percent of students of both genders participated in eighth-grade mathematics, and 28 percent of both boys and girls were enrolled in pre-algebra.[6]

High School

Differences in course enrollment patterns for boys and girls emerge in high school. Unfortunately, national estimates of course-taking patterns are limited. Because of differences in state requirements for graduation, the varying choices students have, and the millions of students enrolled in schools across the country, detailed analyses of which students take which classes are not available for every school year.

TABLE 3.1
Math and Science Course Enrollment of 1994 High School Graduates, by Gender

Subject	Males (%)	Females (%)
Mathematics		
Algebra I	64.7	68.1
Geometry	68.3	72.4
Algebra II	55.4	61.6
Trigonometry	16.6	17.8
Analysis/pre-calculus	16.3	18.2
Statistics/probability	2.0	2.1
Calculus	9.4	9.1
AP calculus	7.2	6.7
Science		
Biology	92.3	94.7
AP/honors biology	4.0	5.1
Chemistry	56.2	58.7
AP/honors chemistry	4.1	3.7
Physics	26.9	22.0
AP/honors physics	3.0	1.8
Engineering	0.4	0.2
Astronomy	2.0	1.5
Geology/earth science	22.8	23.2

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 152, table 138.

To provide policymakers with information on course-taking patterns and course offerings across the country, the Department of Education conducts the High School Transcript Study (HSTS).[7] The most recent data available from the HSTS are for students who graduated from high school in 1994. The HSTS was previously conducted in 1990 and 1987. The 1982 High School and Beyond study also collected information from survey participants' transcripts. The 1994 HSTS incorporates information from 25,000 transcripts from a nationally representative sample of 340 schools.[8]

---

[4] National Science Foundation, Division of Research, Evaluation, and Communication, Directorate for Education and Human Resources, *Indicators of Science and Mathematics Education 1995*, NSF 96-52 (1996), p. 37. James S. Dietz, associate program analyst, National Science Foundation/Education and Human Resources Directorate/Division of Research, Evaluation, and Communication, telephone interview, Feb. 18, 1997. In 1987, educational researchers reported that boys were more likely than equally able girls to be placed in high-ability mathematics groups. *See* Roslyn Arlin Mickleson, "Why Does Jane Read and Write so Well? The Anomaly of Women's Achievement," in Julia Wrigley, ed., *Education and Gender Equality* (Bristol, PA: The Falmer Press, 1992), p. 153. In addition, data on grades of elementary and middle school girls and boys in mathematics and science were not available, so the grades of girls and boys could not be compared.

[5] U.S. Department of Education, National Center for Education Statistics, "NAEP Facts: Eighth Grade Algebra Course-Taking and Mathematics Proficiency," February 1996, p. 2.

[6] Ibid.

[7] U.S. Department of Education, National Center for Education Statistics, *The 1994 High School Transcript Study Tabulations: Comparative Data on Credits Earned and Demographics for 1994, 1990, 1987, and 1982 High School Graduates*, NCES 98-532 (rev. September 1998), p. 1-1.

[8] Ibid.

As shown in table 3.1, among 1994 high school graduates, girls were slightly more likely than boys to have taken most math courses, with the exception of calculus and AP calculus.[9] In addition, slightly higher percentages of girls than boys were found in biology, AP/honors biology, chemistry, AP/honors chemistry, and geology/earth science.[10]

One area where boys continue to outpace girls is enrollment in physics courses. Among 1994 graduates, boys had significantly higher completion rates of at least 1 year of physics (27 percent) than girls (22 percent).[11] The gender disparity had not changed since 1982, when approximately 19 percent of male high school graduates and 10 percent of their female peers had completed physics.[12] A study undertaken by the American Institute of Physics, however, indicates that girls are increasing their representation among students enrolled in physics.[13] Girls constituted 43 percent of high school physics enrollment in 1993, up from 39 percent in 1987. However, girls were a smaller fraction of physics students in more advanced classes.[14]

According to the Department of Education, male and female public high school 1994 graduates earned an almost identical average number of Carnegie units (one credit for the completion of a 1-year course) in math and science. Females had a slight advantage in algebra or higher courses, biology, and chemistry. Males had a sight advantage in general science and physics. In 1994, more females than males took algebra I, geometry, algebra II, trigonometry, analysis/precalculus, and statistics/probability. More boys than girls took calculus and AP calculus. In all cases, the difference in percentages was less than 7 points. In 1994, more girls than boys enrolled in biology, AP/honors biology, chemistry, and geology/earth science. More females than males had two credits in biology and chemistry. More males than females were in AP/honors chemistry, physics, AP/honors physics, engineering, and astronomy. More males than females had three credits in biology, chemistry, and physics. In all cases, the difference in percentages was less than 7 points.[15] It is unclear whether these differences are statistically significant. Further analysis of differences between boys' and girls' experiences within these classes is also warranted.[16]

According to the College Board, more female SAT takers than male SAT takers in 1998 had taken pre-calculus, calculus, chemistry, and biology (see table 3.2). In 1998, the percentage of males who had taken physics decreased from 1997 while the percentage of females taking physics increased. In addition, there were more females than males in honors mathematics classes and honors natural sciences courses.[17] However, girls continue to lag behind boys in experience with computers, computer programming courses, and computer math.[18]

---

[9] 1994 is the most recent year for which statistics are available on course enrollments by high school graduates. Data come from the 1994 High School Transcript Study; tabulations were prepared in October 1996. NCES, *1998 Digest*, p. 152, table 138.

[10] Ibid. Note, however, that NCES does not indicate whether gender differences are statistically significant. Further, percentages represent only those courses that were taken in high school, not courses that were taken in middle school. For example, 93 percent of high school graduates had taken algebra I "before or during" high school, and 70 percent had taken geometry "before or during" high school. Ibid. Therefore, statistics for these courses may not accurately reveal gender differences.

[11] Ibid.; U.S. Department of Education, National Center for Education Statistics, *Condition of Education 1996*, p. 100.

[12] NCES, *Condition of Education 1996*, p. 100; National Science Foundation, *Indicators of Science and Mathematics Education 1995*; Division of Research, Evaluation, and Communication, Directorate for Education and Human Resources, National Science Foundation, *The Learning Curve: What We Are Discovering about U.S. Science and Mathematics Education*, 1996, pp. 15–16; National Science Foundation, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1998*, p. 9.

[13] National Science Foundation, *Women, Minorities, and Persons with Disabilities in Science and Engineering*, pp. 9–10 (citing Michael Neuschatz and Lori Alpert, *Overcoming Inertia: High School Physics in the 1990s: Findings from the 1993 Nationwide Survey of High School Physics Teachers* (College Park, MD: American Institute of Physics, 1995)).

[14] Ibid., pp. 9–10 (citing Neuschatz and Alpert, *Overcoming Inertia*).

[15] NCES, *1998 Digest*, p. 152, table 138.

[16] *See* chap. 2 for a discussion of the types of experiences, such as socialization and student-teacher interaction, that can affect students' achievement and course taking.

[17] The College Board, "1997 Profile of College-Bound Seniors National Report," accessed at <http://www.collegeboard.org/press/senior97>; the College Board, "1998 Profile of College-Bound Seniors National Report," accessed at <http://www.collegeboard.org/sat/cbsenior/yr1998>.

[18] The College Board, "1998 Profile of College-Bound Seniors National Report."

TABLE 3.2
Self-Reported Math and Science Course Taking by College-Bound Seniors Taking the 1998 SAT, by Gender

Subject	Males (%)	Females (%)
Pre-calculus	47	53
Calculus	49	51
Chemistry	45	55
Physics	49	51
Biology	45	55
Computer math	57	43
Computer programming	55	45
Data processing	47	53
Word processing	43	57
No computer courses or experience	46	54

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 152, table 138.

These data suggest that girls who know that they will have the opportunity to go to college are taking the types of courses they need to succeed in college. For example, in a national longitudinal survey, 12th-grade females seemed to give more practical reasons for taking their current mathematics and science classes. While more males than females said they took those classes because of interest and success in both subjects, females more often responded that they took the courses because they needed them for college or trade school, for a job after high school, or for advanced placement credit. More females than males reported that teachers, guidance counselors, parents, friends, or siblings had encouraged them to take the courses they were in.[19]

Thus, while college-bound women and men appear to be taking the courses they need, it is unclear that *all* women (and men) are being offered the guidance and support needed to succeed in math and science.[20] Data for all high school graduates, discussed above, indicate that gender disparities remain in the types of courses male and female students choose, suggesting that equal opportunity and strong encouragement are not standard ingredients in the high school curriculum. Further, the limited data available on course enrollment cannot clearly distinguish the quality of education received—certainly a more qualitative approach is needed to determine if there is equal opportunity in math, science, and technology education.

Achievement in Math and Science

Course-taking patterns and experiences can affect students' achievement in those subjects, and may reflect interest in those courses. As discussed in chapter 2, access to courses and interest in areas is affected by several factors, including: gender-role socialization, self-esteem and confidence in one's abilities, encouragement from teachers and counselors, student-teacher interaction, and harassment and discrimination.[21]

Students' achievement in a particular subject can be measured in a variety of ways. Standardized achievement tests are used to compare students across grades, across schools, or across the country. In this section, several types of achievement tests are discussed to determine if there are differences in male and female scores across the varying types of tests.

National Assessment of Educational Progress

The National Assessment of Education Progress (NAEP) is a congressionally mandated project of DOEd's National Center for Education Statistics (NCES). The NAEP is the only nationally representative and continuing assessment of what students know and can do in various subject areas.[22] Since 1969, assessments have been done periodically in core subjects such as reading, writing, mathematics, and science. NAEP aims to be an integral part of the nation's evaluation of the condition and progress of education and to provide objective information on student performance to policymakers at the national, state, and local levels. The Commissioner of Education Statistics is responsible for providing continuing reviews on NAEP, conducting validity studies of the examinations, and soliciting public comment on NAEP's usefulness and conduct.[23]

---

[19] NCES, *1998 Digest*, p. 153, table 140.

[20] *See* chaps. 2 and 5.

[21] *See* chap. 2.

[22] U.S. Department of Education, National Center for Education Statistics, *NAEP 1996: Mathematics Report Card for the Nation and the States*, February 1997, p. 1.

[23] U.S. Department of Education, National Center for Education Statistics, *NAEP 1992: Mathematics Report Card for the Nation and the States*, April 1993, inside cover.

As shown below, by looking at NAEP scores several different ways, gender disparities become apparent. Thus, it is important that OCR, civil rights advocates, and educational researchers look beyond simple scores to determine if gender differences in achievement are the result of unequal access.

Math Achievement. Overall, average math proficiency scores as measured by the NAEP have increased during the 1990s. This is true for both boys and girls. Further, as shown in figure 3.1, although 9-year-old girls had higher mathematics proficiency than boys in the 1970s and early 1980s, boys' scores have surpassed girls' in the 1990s.[24] Similarly, 13-year-old girls had somewhat higher math proficiency than boys in the 1970s. Since then, boys have received slightly higher math proficiency scores on the NAEP.[25] Seventeen-year-old males consistently have higher scores than females.[26] Not all of these results are statistically significant, yet they do indicate trends in achievement scores. For example, in 1990 and 1992, the differences between 17-year-old boys' and girls' scores were statistically significant. In 1996, only the difference between 9-year-olds was statistically significant.[27] As boys' scores become increasingly higher than girls' scores, the differences may become statistically significant over time. Thus, it is important to determine, particularly at the ages at which differences are significant, if disparities are due to unequal access and/or biased policies and practices.

Further, significant disparities become apparent as the NAEP information on math proficiency are decomposed. For example, when considering the percentage of boys and girls scoring at or above proficiency level, data from the 1996 NAEP show statistically significant differences between boys and girls in fourth- and eighth-grade math (9-year-olds and 13-year-olds).[28] Overall, boys outperformed girls nationally and in nine states on the NAEP fourth-grade mathematics assessment. Twenty-four percent of fourth-grade boys in the United States met or exceeded the proficiency level of the NAEP mathematics assessment in 1996, compared with only 19 percent of girls.[29] Fewer female than male fourth graders met the math proficiency level in Connecticut, the District of Columbia, Minnesota, Montana, New Jersey, Rhode Island, Utah, Washington, and Wisconsin.[30] Eighth-grade boys outperformed girls on the NAEP math assessment in six states: Colorado, Nebraska, North Carolina, South Carolina, Utah, and Virginia.[31] Among 12th graders, nationally, 18 percent of boys and 14 percent of girls scored at or above proficiency level in math. There were no significant differences between boys and girls of any age group who were at, above, or below basic math proficiency.[32]

Again, as the scores are further decomposed, greater gender differences can be seen. As shown in table 3.3, boys and girls exhibit similar proficiency in certain areas, such as beginning skills and problem solving, but the gender gap widens as the tasks become more complex.

Science Achievement. Gender gaps are larger in science achievement scores than in math achievement scores. As shown in figure 3.2, boys have consistently scored slightly higher than girls on NAEP science achievement tests.[33]

In 1996, gender differences in science achievement were statistically significant for 17-year-olds.[34] Among fourth graders, girls' 1996 NAEP science scores were not significantly different from boys' scores. However, eighth-grade boys outperformed females in 19 states on the 1996 NAEP science assessment.[35]

---

[24] NCES, *1998 Digest*.

[25] Ibid.

[26] Ibid.

[27] NCES, *NAEP 1996*, p. 31.

[28] National Education Goals Panel, *Mathematics and Science Achievement State by State, 1998* (Washington, DC: Government Printing Office, 1998), pp. 270–82.

[29] Ibid., p. 12.

[30] Ibid., p. 270.

[31] Ibid., p. 275.

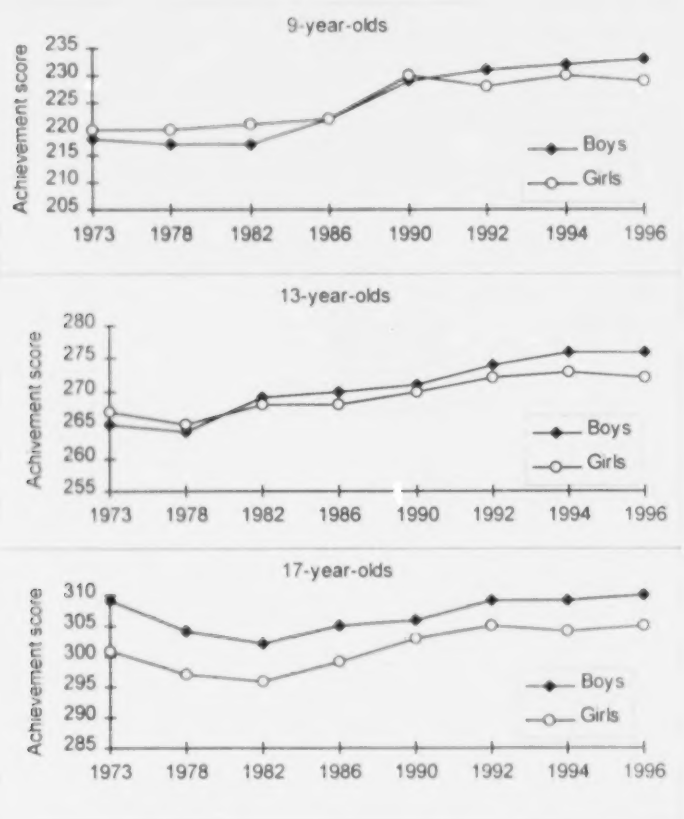
[32] NCES, *NAEP 1996*, pp. 52–53.

[33] NCES, *1998 Digest*, p. 144.

[34] U.S. Department of Education, National Center for Education Statistics, *NAEP 1996: Mathematics Report Card for the Nation and the States*, May 1997, pp. 28–29.

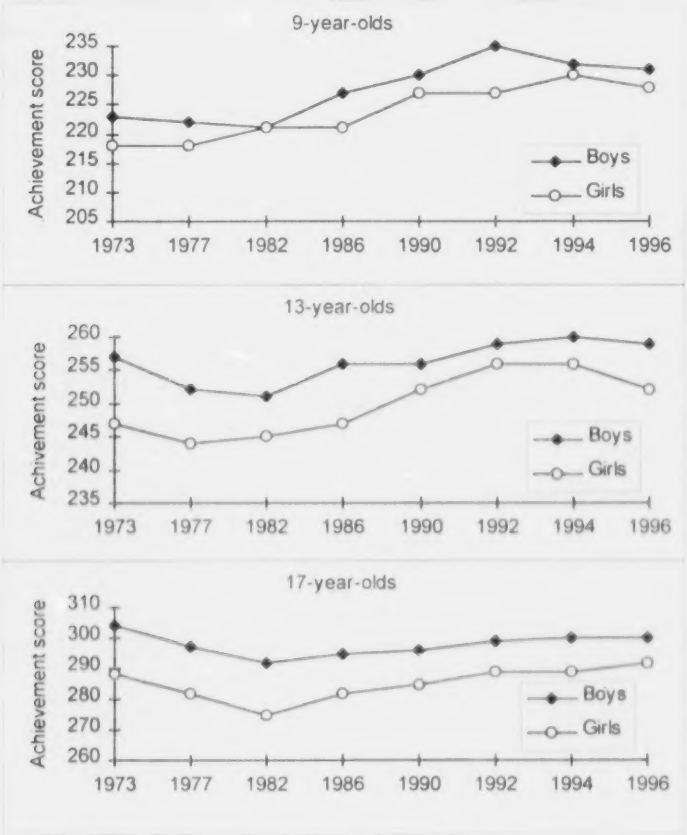
[35] National Education Goals Panel, *Mathematics and Science Achievement State by State, 1998*, p. 279. The difference between girls' and boys' scores was significantly different in the following states: Alaska, Arkansas, Colorado, Georgia, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Mexico, New York, North Dakota, Oregon, Texas, Utah, Washington, and Wisconsin. Ibid.

FIGURE 3.1
Average Mathematics Proficiency, by Age and Gender, 1973–1996



SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 136, table 120.

FIGURE 3.2
Average Science Proficiency, by Age and Gender, 1973–1996



SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 144, table 128.

TABLE 3.3
Students at or above Selected NAEP Mathematics Proficiency Levels, by Gender, 1996

Mathematics proficiency level	Boys (%)	Girls (%)
9-year-olds		
Simple arithmetic facts	99.1	99.1
Beginning skills and understanding	82.5	80.7
Numerical operations and beginning problem solving	32.7	26.7
Moderately complex procedures and reasoning	2.0	1.2
13-year-olds		
Beginning skills and understanding	98.7	98.8
Numerical operations and beginning problem solving	79.8	77.4
Moderately complex procedures and reasoning	23.0	18.4
Multi-step problem solving and algebra	0.8	0.5
17-year-olds		
Beginning skills and understanding	100.0	100.0
Numerical operations and beginning problem solving	97.0	96.7
Moderately complex procedures and reasoning	62.7	57.6
Multi-step problem solving and algebra	9.5	5.3

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 137, 141.

TABLE 3.4
Students at or above Selected NAEP Science Proficiency Levels, by Gender, 1996

Science proficiency level	Boys (%)	Girls (%)
9-year-olds		
Know everyday science facts	96.9	96.6
Understand simple scientific principles	76.8	75.5
Apply general scientific information	33.9	30.7
Analyze scientific procedures and data	5.2	3.6
13-year-olds		
Understand simple scientific principles	93.2	90.9
Apply general scientific information	61.7	53.8
Analyze scientific procedures and data	15.5	9.2
Integrate specialized scientific information	0.7	0.2
17-year-olds		
Understand simple scientific principles	97.5	98.1
Apply general scientific information	83.8	83.7
Analyze scientific procedures and data	53.1	43.9
Integrate specialized scientific information	14.2	7.4

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 142, table 126.

Similar to math scores, when decomposed, science scores show greater gender differences. As shown in table 3.4, 17-year-old boys are almost twice as likely as 17-year-old girls to be at or above proficiency level in integrating specialized scientific information. Similarly, 43.9 percent of girls, compared with 53.1 percent of boys, are proficient in analyzing scientific procedures and data.[36]

Third International Mathematics and Science Study

Conducted in 1995, the Third International Mathematics and Science Study (TIMSS) was a comprehensive comparative international study of a half-million students at five grade levels in 41 countries.[37] TIMSS data show that there was not a significant difference between girls and boys in fourth- or eighth-grade math achievement or eighth-grade science achievement. However, TIMSS data suggested that there was a gender gap in fourth-grade science achievement.[38] Although no gender gap in general mathematics knowledge was found, TIMSS data showed that in the United States in 1995 a gender gap existed in general knowledge of science, physics, and advanced mathematics.[39]

College Entrance Exams

A variety of other standardized tests are used to assess student achievement and often are used for placement purposes to determine a student's suitability for college. The Scholastic Assessment Tests are sponsored by the College Entrance Examination Board (College Board), and are developed and administered by the Educational Testing Service (ETS). The SAT contains a verbal and a mathematics section. The SAT II tests are sponsored by the College Board and administered by the Educational Testing Service.[40]

According to the College Board, 12th-grade girls continue to outscore boys on verbal and writing tests, while boys score higher than girls on tests of natural science, mechanical skills, and mathematics.[41] As shown in table 3.5, since 1972, males have scored higher than females on the math portion of the SAT I, scoring 36 points higher than females in 1999.[42]

---

[36] NCES, *1998 Digest*, p. 142.

[37] U.S. Department of Education, National Center for Education Statistics, "Pursuing Excellence: A Study of U.S. Eighth-Grade Mathematics and Science Teaching, Learning, Curriculum, and Achievement in International Context," 1996, Executive Summary, accessed at <http://www.nces.ed.gov/timss/97198-2.html>.

[38] U.S. Department of Education, National Center for Education Statistics, "Pursuing Excellence: A Study of U.S. Fourth-Grade Mathematics and Science Achievement in International Context," 1997, chap. 1, accessed at <http://www.nces.ed.gov/timss/report/97255-1.html>; U.S. Department of Education, Office of Educational Research and Improvement (OERI), *Highlights from TIMSS: The Third International Mathematics and Science Study*, NCES 1999-081 (March 1999), p. 11.

[39] U.S. Department of Education, National Center for Education Statistics, "Pursuing Excellence: Initial Findings from the Third International Mathematics and Science Study (TIMSS); A Study of U.S. Twelfth-Grade Mathematics and Science Achievement in International Context," chap. 2, accessed at <http://www.nces.ed.gov/timss/twelfth/chap2.html#Math-How Well>; OERI, *Highlights from TiMSS*, p. 11.

[40] College Entrance Examination Board and Educational Testing Service, *SAT Program: Taking the SAT II Subject Tests*, 1996, pp. 2–3. Tests related to mathematics and science are: Mathematics Level I (covering algebraic functions, basic trigonometry, elementary statistics, and plane and coordinate geometry); Mathematics Level IC (directed at students who are accustomed to using calculators in mathematics classes); Mathematics Level IIC (covering solid geometry, functions, statistics and permutations, logic and proof, and elementary number theory); Biology (covering cellular and molecular biology, ecology, genetics, and evolution and diversity); Chemistry (covering atomic and molecular structures, states of matter, equilibrium and reaction rates, and laboratory procedures); Physics (covering mechanics, electricity and magnetism, waves, and relativity). Scores on each of these examinations range from 200 to 800 points. *See* the College Board, *SAT II*, pp. 26, 36, 40, 44; Grechen Rigol, director of SAT II Test Program, College Entrance Examination Board, telephone interview, Feb. 20, 1997.

[41] The College Board, "SAT and Gender Differences," RS-4 (February 1998), p. 3, accessed at <http://www.collegeboard.org>.

[42] The College Board, "Mean SAT/SAT I Scores for College-Bound Seniors, 1972–1999," *1999 Profile of College-Bound Seniors National Report*, accessed at <http://www.collegeboard.org/sat/cbsenior/yr1999/NAT/72-99.html>. The College Board does not report whether this represents a statistically significant difference; however, a difference of 36 points is approximately a 7 percent advantage in favor of males. *See also* NCES, *1998 Digest*, p. 146, table 132.

TABLE 3.5
Mean Math SAT Scores, by Gender, Selected Years

Year	Males	Females
1972	527	489
1975	518	479
1980	515	473
1985	522	480
1990	521	483
1995	525	490
1999	531	495

Source: The College Board, "Mean SAT/SAT I Scores for College-Bound Seniors, 1972–1999," *1999 Profile of College-Bound Seniors National Report*, accessed at <http://www.collegeboard.org/sat/cbsenior/yr1999/NAT/72-99.html>.

TABLE 3.6
SAT II Scores, by Gender, 1998

Subject	Males	Females
Math level I	587	554
Math level IC	593	561
Math level IIC	665	629
Biology	613	589
Chemistry	621	587
Physics	652	608
Ecological biology	568	541
Molecular biology	610	585

SOURCE: Meri Escandón, assistant director, Admission & Enrollment Services, the College Board, letter to Monique Cueto, intern, U.S. Commission on Civil Rights, July 6, 1999, sent via facsimile, attachments.

TABLE 3.7
Average ACT Scores, by Gender, Selected Years

	Mathematics		*Natural Science*	
Year	Males	Females	Males	Females
1970	19.3	16.2	22.4	20.0
1975	18.9	16.2	22.4	20.0
1980	18.9	16.0	22.3	20.0
1985	18.6	16.0	22.6	20.0
1990	20.7	19.3	–	–
1995	20.9	19.7	21.6	20.5
1997	21.3	20.1	21.7	20.6

SOURCE: U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics 1998*, NCES 1999-036 (May 1999), p. 149, table 135. A new version of the ACT was introduced in 1990, therefore scores from previous years are not comparable. Data are not available for the 1990 science ACT. Ibid.

On the SAT II subject tests in 1998, more females than males took the Math Level I, Math Level II, Biology, Ecological Biology, and Molecular Biology subject tests, while more males than females took the Math Level IIC, Chemistry, and Physics tests.[43] Despite the greater participation of females in the majority of these mathematics- and science-related subject tests, the females did not score higher than males on any of the tests (see table 3.6). The greatest difference in average scores was 44 points in favor of the males on the Physics test, followed by a 36-point difference on the Math Level IIC test.[44]

Another test used for college admissions is American College Testing (ACT), sponsored by ACT, Inc. On this test as well, males outscore females on the math and science portions, while females outscore males on the English portions (see table 3.7).[45]

Math and Science Advanced Placement Exams

The Advanced Placement (AP) program is a cooperative educational endeavor based on the premise that college-level material can be taught successfully to able and well-prepared secondary school students. The program is sponsored by the College Board, which contracts with the Educational Testing Service for technical and operational services. More than one-half of the nation's 21,000 high schools participate in the AP program. AP examinations are composed of an open-ended section (which allows students to demonstrate their depth of understanding and ability to organize and present ideas) and a multiple-choice section (which gives breadth to the examinations).[46]

---

[43] Meri Escandón, assistant director, Admission & Enrollment Services, the College Board, letter to Monique Cueto, intern, U.S. Commission on Civil Rights, July 6, 1999, sent via facsimile, attachments.

[44] Ibid.

[45] NCES, *1998 Digest*, p. 149, table 135; ACT, Inc., "Male and Female ACT Scores by Racial/Ethnic Group, 1996–98," information provided by facsimile, June 30, 1999. The information provided to the Commission does not indicate whether male-female differences are statistically significant.

[46] Participating postsecondary institutions award academic credits and/or placement to students who have done "well," where "well" is defined as scoring at least a 3 on a scale of 1–5. Virtually all of the nation's colleges and universities have an AP policy granting incoming students academic credit for qualifying scores on the AP examination. Approximately 50 percent of the nation's colleges and universities have reported to the College Board that they allow students to be-

TABLE 3.8
Advanced Placement Test Participation, by Gender, 1998

Subject	Males (%)	Females (%)
Biology	43	57
Chemistry	57	43
Computer science A	82	18
Computer science b	88	12
English language	38	62
English literature	36	64
Environmental science	46	54
Calculus AB	53	47
Calculus BC	62	38
Physics B	66	34
Physics C: mechanics and physics	73	27
Physics C: electricity and magnetism	78	22

SOURCE: Derived from Educational Testing Services, "Program Summary Report," provided via facsimile to Monique Cueto, intern, U.S. Commission on Civil Rights, June 28, 1999.

Overall, girls are less likely than boys to take mathematics- and science-related AP examinations, which can be used to earn college-level credit.[47] However, the College Board reports a growth in the number of female participants in AP examinations, particularly in math and science.[48] In 1996, 55 percent of all AP candidates were female, up from 49 percent in 1986. Approximately 43 percent of all math- and science-related AP examinations were completed by girls, up from approximately 33 percent in the 1980s.[49]

Although girls have increased their participation in mathematics- and science-related AP examinations since the 1980s, girls still do not participate in the tests at the same rate as boys. On the 1998 AP exams for mathematics- and science-related subjects, males were more likely to participate in 8 of the 10 exams available.[50] As shown in table 3.8, girls represented a higher share of participants in Calculus AB (47 percent) than in the more demanding Calculus BC (38 percent).[51] Girls are particularly underrepresented among participants in the physics examinations, representing about one-third of those who take the Basic Physics examination and between one-fifth and one-quarter of those taking the Mechanics and Physics and Electricity and Magnetism examinations.[52]

Not only are girls less likely than boys to take the mathematics- and science-related AP examinations, but a substantially smaller percentage of girls taking the examinations achieves a score of 3 or above. In 1996, for instance, depending on the particular examination, the percentage of girls scoring 3 or above was between 7 and 16 percent below that of boys. In 1998, males outscored females on all of the math and science tests (see table 3.9). The biggest difference in average scores was 0.71 points in favor of the boys in the Physics C: Electricity and Magnetism exam, followed by a 0.57-point advantage for the boys on the Physics B exam.[53]

gin as sophomores based on a sufficient number of qualifying grades on AP examinations. College Entrance Examination, *The AP Program National Summary Report: 1996*, p. 1; College Entrance Examination Board, *1996 Advanced Placement Yearbook*, pp. 1, 8, 25, 28.

[47] The College Board, *1996 Advanced Placement Yearbook*, pp. 1, 8, 25, 28. The AP examinations related to mathematics and science include: Calculus AB: This examination covers differential and integral calculus topics that are typically included in an introductory calculus I course (e.g., properties of functions and graphs, limits and continuity); Calculus BC: This examination covers additional topics in differential and integral calculus, as well as sequences and series. The subject matter on this examination is typically included in a 2-semester sequence (calculus I and II); Biology: This examination is based on a 1-year introductory college course with a lab component, and topics include cells and molecules, genetics and evolution, ecology, and organisms and populations; Chemistry: This examination is based on a 1-year introductory college course with a lab component, and topics include atomic theory and structure, chemical bonding, states of matter, reactions, and laboratory procedures; Basic Physics: This examination is based on a 1-year noncalculus college course on general physics, and topics include mechanics, electricity, kinetic theory, waves and optics, and modern physics; Physics—Mechanics: This examination covers in-depth topics related to Newtonian mechanics, such as kinematics; laws of motion; and work, energy, and power; Physics—Electricity and Magnetism: This examination covers electrostatics, electric circuits, and magnetostatics. Ibid., p. 25.

[48] Ibid., p. 4.

[49] Ibid.

[50] Educational Testing Services, "Program Summary Report," provided via facsimile to Monique Cueto, intern, U.S. Commission on Civil Rights, June 28, 1999.

[51] Ibid.

[52] Ibid.

[53] Ibid.

TABLE 3.9
Advanced Placement Test Scores, by Gender, 1998

Subject	Males	Females
Biology	3.22	2.85
Chemistry	3.01	2.60
Computer science A	2.57	2.19
Computer science B	3.38	3.22
English language	3.04	2.96
English literature	3.02	3.06
Environmental science	3.07	2.59
Calculus AB	3.18	2.89
Calculus BC	3.74	3.39
Physics B	3.15	2.58
Physics C: mechanics and physics	3.46	2.75
Physics C: electricity and magnetism	3.35	2.95

SOURCE: Educational Testing Services, "Program Summary Report," provided via facsimile to Monique Cueto, intern, U.S. Commission on Civil Rights, June 28, 1999.

POSTSECONDARY EDUCATION

College Plans

Naturally, high school experiences and course taking have an impact on college and career choices. A student's access to and achievement in a certain area can influence his or her decision to pursue that area. Failure to take math and science courses or low achievement (or perceived low achievement) discourages many students from pursuing degrees in math-, science-, and technology-related fields. It is critical that those decisions are not made because of limited opportunities and violations of Title IX.

The College Board reported that in 1998, more female than male seniors planned for advanced standing in college biology. However, more males than females planned for advanced standing in chemistry, computer science, mathematics, and physics (see figure 3.3).[54] Correspondingly, as shown in figure 3.4, females were more likely than males to plan on majoring in biological sciences, health and allied services, and social sciences and history, while more males than females reported that they intended to major in mathematics, physical sciences, and business and commerce. Of the 87,944 students who planned on majoring in engineering, 81 percent were male and 19 percent were female.[55]

College and Graduate Degrees

According to the U.S. Department of Education's *Digest of Education Statistics: 1998*, more women than men are enrolled in institutions of higher education.[56] However, gender differences exist in the types of degrees men and women receive. Thirty-seven percent of persons 18 and over who hold a bachelor's degree or higher in biology are female. Thirteen percent of persons 18 and over who hold a bachelor's degree or higher in engineering are female. Thirty-seven percent of persons 18 and over who hold a bachelor's degree or higher in mathematics and statistics are female. Twenty-nine percent of persons 18 and over who hold a bachelor's degree or higher in physical and earth sciences are female.[57]

However, gender differences in degree completion become more distinct at higher levels of education. Data for the 1995–1996 school year show:

- While more bachelor's and master's degrees went to women in biological and life sciences, less than half of the doctorate degrees went to women.
- Women received 16 percent of the bachelor's and master's degrees in engineering and engineering-related technologies, and 13 percent of the doctorate degrees in these fields.
- Women earned 46 percent of bachelor's degrees, 39 percent of master's degrees, and only 20 percent of the doctorate degrees in mathematics.
- In the physical sciences, 36 percent of the bachelor's degrees, 32 percent of the master's degrees, and 23 percent of the doctorate degrees went to women.
- In chemistry, women received 43 percent of the bachelor's degrees, 44 percent of the master's degrees, and 30 percent of the doctorate degrees.
- In physics, 18 percent of the bachelor's and master's degrees, and 13 percent of the doctorate degrees went to women.[58]

[54] The College Board, "1998 Profile of College-Bound Seniors National Report."

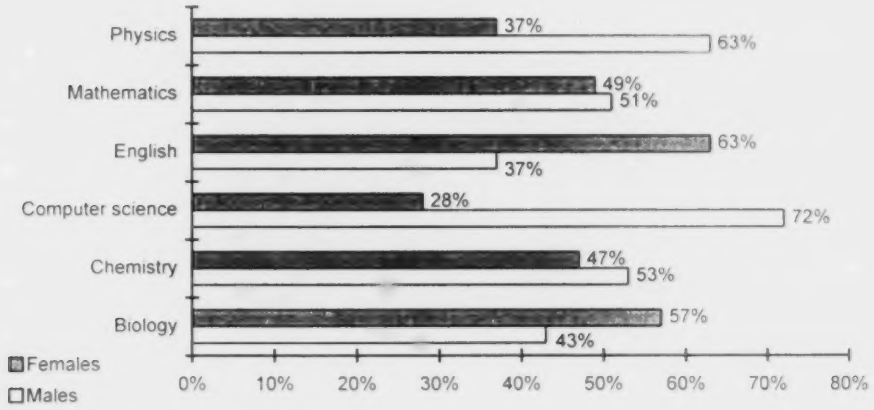
[55] Ibid.

[56] NCES, *1998 Digest*, p. 198, table 174.

[57] Ibid., p. 19, table 10. *See* chap. 2.

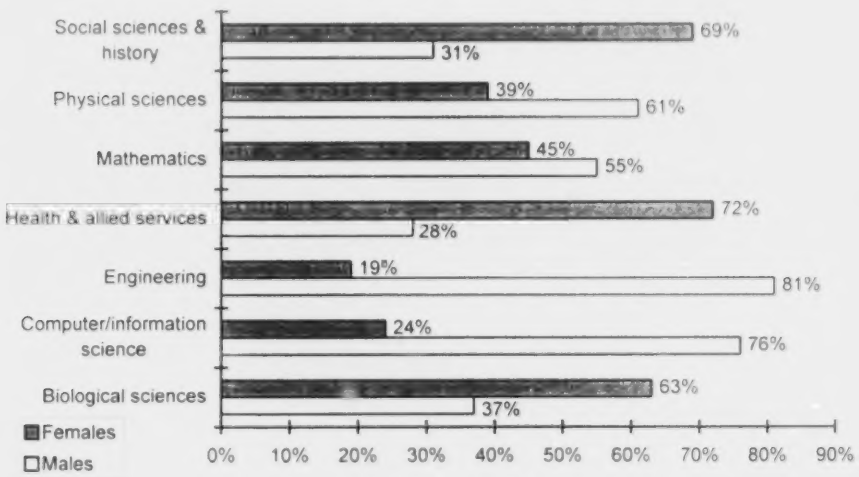
[58] Ibid., pp. 303, 306, 309, tables 265, 268, 271.

FIGURE 3.3
Planned Advanced Standing in College Courses of SAT Takers, by Gender, 1998



SOURCE: The College Board, "1998 Profile of College Bound Seniors National Report," accessed at <http://collegeboard.org/sat/cbsenior/yr1998>.

FIGURE 3.4
Planned College Major of SAT Takers, by Gender, 1998



SOURCE: The College Board, "1998 Profile of College Bound Seniors National Report," accessed at <http://collegeboard.org/sat/cbsenior/yr1998>.

Women of color (black non-Hispanic, Hispanic, Asian, and American Indian women) received less than 10 percent of the bachelor's, master's, and doctorate degrees in all math-, science-, and technology-related fields. Of the total bachelor's, master's, and doctorate degrees conferred to women, white non-Hispanics received the most degrees in biological/life sciences, computer/information sciences, engineering and related fields, English, mathematics, and physical sciences.[59] Further, although the number of women receiving a bachelor's, master's, or doctorate degree in biological and life sciences, engineering, and physical sciences has been increasing, the number of women receiving these degrees in mathematics has started to drop.[60]

Women in Science and Engineering Fields

Although women made up 46 percent of the U.S. labor force in 1995, they were 22 percent of the science and engineering labor force. Short-term trends have shown a slight increase in the representation of women with doctorate degrees in science and engineering employment. In 1995, 22 percent of doctoral scientists and engineers were women, compared with 20 percent in 1993 and 19 percent in 1991.[61] Minority women are 19 percent of all women in the science and engineering labor force, and they make up 4.2 percent of all scientists and engineers in the labor force.[62]

As is the case with degree completion, women are employed more in some science and engineering fields than in others. Women account for more than half of all psychologists, but only 12 percent of physicists and 9 percent of engineers. Within engineering, women are 13 percent of chemical and industrial engineers, but only 6 percent of aerospace, electrical, and mechanical engineers. Further, women make up less than 30 percent of the computer science labor force.[63]

Minority women's field choices are more similar to those of white women than they are to those of minority men. Higher proportions of women than men within each racial/ethnic group are in computer or mathematical sciences, life sciences, and social sciences, and lower proportions are in engineering.[64]

Educational Background

In the science labor force as a whole, 15 percent of women and 21 percent of men hold doctoral degrees. This difference, however, is much greater in certain fields. In biology, 25 percent of women and 41 percent of men hold doctoral degrees, and in chemistry, 13 percent of women and 27 percent of men hold doctoral degrees. Differences in highest degree attained affects differences in employment and salary in science and engineering fields.[65]

Employment

Female scientists and engineers are less likely than men to be employed full time in their fields. Of those who were employed, 74 percent of women and 86 percent of men were employed full time in their degree fields. Compared with white, Hispanic, and American Indian women, black and Asian female scientists and engineers are more likely to be employed full time in their fields. The percentage of men and women employed full time outside their degree fields, and the reasons given for doing so, were similar for men and women. However, women were more likely than men to cite family-related reasons, like children or spouse's job, for working outside their degree fields.[66]

Within fields, women are about as likely as men to choose industrial employment. However, among scientists and engineers as a whole, women are less likely than men to be employed in business or industry and are more likely to be employed in educational institutions.[67]

In academic employment, female scientists and engineers are more likely than men to be employed in elementary or secondary schools and in 2-year colleges. In 4-year colleges and universities, female scientists and engineers hold fewer high-ranking positions than men. Women are less likely than men to be full professors but are more likely than men to be assis-

---

[59] Ibid.

[60] Ibid., pp. 314, 317, 320, tables 278, 284, 290, 291.

[61] National Science Foundation, *Women, Minorities, and Persons with Disabilities in Science and Engineering*, pp. 99–101

[62] Ibid., p. 113.

[63] Ibid., p. 99.

[64] Ibid., p. 113.

[65] Ibid., p. 99.

[66] Ibid., p. 101.

[67] Ibid., pp. 101–02.

tant professors. Among ranked science and engineering faculty, 49 percent of men and 24 percent of women are full professors. Thirty-five percent of full-time employed female science and engineering faculty and 59 percent of their male peers are tenured. Time in rank and productivity are the most important factors influencing promotion in academia; however, women had fewer publications in refereed journals than men between 1990 and 1995. Differences in publication rates can partially be explained by differences in field, age, and years since doctorate. Women are also less likely than men to have patents. Differences in research support do not appear to influence differences in publications and patents because female faculty are as likely as male faculty to receive support from federal contracts or grants.[68]

Minority women are less likely than white women and men of any racial/ethnic group to be full professors and be tenured. Thirty-six percent of black women, 25 percent of Hispanic women, and 17 percent of Asian women are tenured, compared with 38 percent of white women, 62 percent of white men, and between 39 and 50 percent of black, Hispanic, and Asian men.[69]

In nonacademic employment, women are as likely as men to be in management or administration, but men usually have more subordinates than women do. The primary work activity of female scientists and engineers in business or industry differs from that done by men because of differences in field. Men, for example, are more likely than women to be engineers and physical scientists and as a result are more likely to be engaged in research and development. Although publications are not as important in industry and business as in academia, patents are. Women scientists and engineers are less likely than men to have patents.[70]

For the most part, minority women scientists and engineers in business or industry have similar work activities to those of white women and minority men. Regardless of racial/ethnic group, women are more likely than men to work in computer applications and are less likely than men to work in research and development.[71]

Salaries

Full-time employed female scientists and engineers earn less than men, and these differences are mostly due to differences in age and field. Female scientists and engineers are younger than men on average, and they are less likely than men to be in computer science or engineering fields, which command higher salaries. With increasing age, the gender gap in salary widens. In 1995, among computer and mathematical scientists with bachelor's degrees between the ages of 20 and 29, the median salary for men was $3,000 higher than the median salary for women. Among computer and mathematical scientists with bachelor's degrees between the ages of 40 and 49, the median salary for men was $9,000 higher than the median salary for women. Some of this difference can be explained by the lesser prevalence of women in higher positions in academe and industry.[72]

Median annual salaries of minority women are similar to those of both white women and minority men.[73]

---

[68] Ibid., pp. 103–04.

[69] Ibid., p. 113.

[70] Ibid., p. 104.

[71] Ibid., p. 114.

[72] Ibid., p. 105.

[73] Ibid., p. 114.

CHAPTER 4

The Department of Education: Ensuring Nondiscrimination and Promoting Gender Equity

RESPONSIBILITY FOR CIVIL RIGHTS ENFORCEMENT AND GENDER EQUITY PROGRAMS

Office for Civil Rights

Mission and Function

The Office for Civil Rights (OCR) of the U.S. Department of Education (DOEd) is responsible for enforcing civil rights statutes in the educational context.[1] In addition to enforcing Title IX of the Education Amendments of 1972,[2] OCR enforces Title VI of the Civil Rights Act of 1964[3] and Section 504 of the Rehabilitation Act of 1973.[4] OCR's civil rights implementation and enforcement activities include civil rights policy development and dissemination, investigation of complaints alleging discrimination by recipients of DOEd's financial assistance, and initiation of enforcement actions against recipients who refuse to comply with civil rights requirements willingly. In addition, OCR promotes civil rights compliance and uncovers and remedies instances of noncompliance. OCR's activities include: conducting outreach and education to inform applicants, recipients, participants, and beneficiaries of DOEd-funded programs of civil rights requirements; providing technical assistance to recipients to help them comply with civil rights requirements; and conducting compliance reviews of recipients to uncover and remedy violations of civil rights laws.[5]

Strategic Planning

OCR's draft Strategic Plan, dated February 6, 1996, states that, under its first goal of having an impact on students' lives, 80 percent of its resources will be directed toward "ensuring equal access to high quality, high standards education,"[6] in areas such as:

- Admissions.
- Testing and assessment.
- Overrepresentation of minorities in special education and low-track courses.
- Underrepresentation of women and minorities in advanced math and science courses.
- Program access for limited-English-proficient students.
- Segregation in elementary and secondary schools.[7]

OCR also specified that 10 percent of its resources will be devoted to racial and sexual harassment, 5 percent to gender equity in athletics,

[1] *See* U.S. Department of Education (DOEd), Office for Civil Rights (OCR), *Office for Civil Rights Fiscal Year 1998 Annual Report to Congress: Guaranteeing Equal Access to High-Standards Education*, 1998.

[2] Pub. L. No. 92-318, tit. IX, 86 Stat. 373 (codified as amended at 20 U.S.C. §§ 1681–1688 (1994)).

[3] Pub. L. No. 88-352, tit. VI, 78 Stat. 252 (codified as amended at 42 U.S.C. §§ 2000d–2000d-7 (1994)).

[4] Pub. L. No. 93-112, tit. V, § 504, 87 Stat. 394 (codified as amended at 29 U.S.C. § 794 (1994)). In addition to these statutes, OCR also enforces the Age Discrimination Act of 1975 and the Americans with Disabilities Act of 1990, and helps implement civil rights provisions in Title V, Part A, of the Elementary and Secondary Education Act. *See* U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, December 1996, p. 149.

[5] U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, pp. 150–51. *See also* U.S. Commission on Civil Rights, *Federal Title VI Enforcement to Ensure Nondiscrimination in Federally Assisted Programs*, June 1996, chap. 5.

[6] U.S. Department of Education, Office for Civil Rights, Strategic Plan, draft, Feb. 2, 1996, p. 2.

[7] Ibid.

and 5 percent to desegregation in higher education.[8] In addition, OCR's draft Strategic Plan calls for the development of issue area teams in its priority areas, and the use of strong remedial plans.[9]

Other goals of OCR's draft Strategic Plan focus on investment in its staff and the empowerment of students and parents. In order to empower students and parents to secure equal access to quality education, OCR plans to articulate clearly its policies to the public, advocate educational programs that are successful in achieving equal access, and target technical assistance and outreach to help communities implement strategies to achieve equal access to education.[10]

OCR's Strategic Plan sets the course for achieving equal opportunity in educational programs. However, although the plan provides short- and long-term strategies, it does not clearly articulate how its goals will be achieved in specific priority areas. For example, there is no discussion of how OCR will address underrepresentation of women and girls in advanced mathematics, science, and technology education.

Further, OCR's Strategic Plan remains in draft form and is not directly linked to the Department's plan. The Department's plan stated the agency's mission is to "ensure equal access to education and to promote educational excellence throughout the nation."[11] However, the Department's seven priorities do not directly reference civil rights.[12] Although the priorities are directed toward "all" students, the Department neglects to identify elimination of discriminatory barriers or other equal opportunity issues as a priority. Further, there is little discussion in the Department's plan of what role OCR will play in achieving the Department's priorities and goals.

Budget

In 1997, the 682 employees designated for direct support of civil rights issues (employees in the Office for Civil Rights and the Title IV Training and Advisory Services and Women's Equal Educational Equity programs) represented 15.3 percent of the total number of full-time employees at DOEd, and 6.8 percent of the agency's salaries and expenses.[13] However, program funding for these offices amounted to less that 1 percent of the total funding for the agency.[14] In FY 1998, OCR received a budget appropriation of $61.5 million.[15] However, it is not clear from annual reports how much resources OCR spent on issues related to equal access for women and girls in advanced math, science, and technology education.[16]

Office of General Counsel

Another DOEd office that enforces Title IX and other civil rights statutes is the Office of General Counsel (OGC). The General Counsel is the principal advisor to the Secretary of Education on all legal matters affecting departmental programs and activities.[17] With respect to civil

---

[8] Ibid.

[9] Ibid., pp. 2–3.

[10] Ibid., pp. 4–6.

[11] U.S. Department of Education, *Strategic Plan, 1998–2002*, Sept. 30, 1997, p. 9.

[12] The Department's priorities are to ensure that all students are able to: (1) read independently by the end of the third grade; (2) master challenging mathematics concepts (i.e., algebra and geometry) by the end of the eighth grade; (3) be prepared for and able to afford 2 years of college by age 18, and able to pursue lifelong learning as adults; (4) have dedicated and well-prepared teachers; (5) be technologically literate and have classrooms dedicated to the Internet; (6) learn in safe, drug-free schools; and (7) learn according to clear standards of achievement and accountability. DOEd, *Strategic Plan, 1998–2002*, p. 5.

[13] DOEd, *Strategic Plan, 1998–2002*, p. 54.

[14] Ibid. This figure is based on the resources for "Program Funding," totaling $66,744,655 less the funds made available by the Department to banks for new student loans. OCR's budget in FY 1997 was $54.9 million. Ibid., p. 60; *see also* U.S. Department of Education, Office for Civil Rights, *Office for Civil Rights Fiscal Year 1998 Annual Report to Congress: Guaranteeing Equal Access to High-Standards Education*, 1998, p. 10.

[15] OCR, *Fiscal Year 1998 Annual Report to Congress*, p. 10.

[16] There also is no discussion of any complaints filed or compliance reviews conducted concerning women and girls in math, science, and technology. OCR, *Fiscal Year 1998 Annual Report to Congress*, pp. 20–23.

[17] U.S. Department of Education, Administrative Communications Systems, Mission and Organizational Manual, Office of the General Counsel, vol. I, pt. B (1992), p. 1 (hereafter cited as OGC, 1992 Mission Manual). OGC's mission includes the following: (1) provides legal advice and services to the Secretary, Deputy Secretary, principal officers of the Department of Education, or any other person authorized to request such advice or services; (2) prepares and reviews public documents, rules, regulations issued by DOEd, and legal instruments entered into by the Department; (3) represents the Secretary, DOEd, or any of its officers or units in court or administrative litigation, except for administrative proceedings initiated by the Office for Civil Rights; (4) serves as liaison to other federal agencies in connection with legal

rights, OGC reviews all civil rights regulations and policies developed by OCR before they are submitted to the Secretary of Education for approval and advises the Secretary as to their legal sufficiency. OGC brings together both program assistance and enforcement issues in the areas of race, national origin, age, gender, and disability.[18] Based on OGC's role as legal advisor to the Secretary, the General Counsel aims to ensure that OCR and the Office of Elementary and Secondary Education, the Office of Special Education and Rehabilitative Services, and the Office of Bilingual Education and Minority Language Affairs have consistent approaches to issues where there are overlapping areas of responsibility.[19]

For civil rights enforcement, OGC is neither the legal arm of OCR nor a party to any administrative proceedings initiated by OCR. However, the General Counsel is responsible for all federal court litigation involving the department, including civil rights litigation. As a practical matter, the General Counsel often relies on OCR to perform much of the work relating to civil rights litigation, subject to the General Counsel's review.[20] A 1980 memorandum details the responsibilities of OGC and OCR with respect to three types of litigation activity: referral of cases to the Department of Justice, *amicus curiae* briefs, and defensive litigation. Based in part on the advice of OCR, civil rights cases are referred to the U.S. Department of Justice for litigation by the Office of General Counsel. Similarly, DOEd recommends that the Department of Justice file an *amicus curiae* brief upon the advice of the Assistant Secretary for Civil Rights, after review by the General Counsel. In civil rights cases filed against the Department of Education, the General Counsel is responsible for coordinating the Department of Education's defense with the Department of Justice, and uses OCR's expertise and staff resources. However, OGC has primary responsibility for all litigation matters.[21]

Office of Elementary and Secondary Education

Among DOEd's program offices, the Office of Elementary and Secondary Education (OESE) manages various congressionally mandated programs that provide financial assistance to public and private school children. OESE's mission charges the office with: (1) assisting secondary students and assuring equal access to services for all children, particularly Native Americans and children of migrant workers; (2) assisting state and local educational agencies in the process of school desegregation; and (3) assisting K–12 teachers in improving the quality of their teaching.[22]

Many of the programs administered by OESE are based on the passage of the Elementary and Secondary Education Act (ESEA)[23] in 1965 and its eight subsequent reauthorizations. These programs are geared to helping all K–12 children regardless of their race, national origin, gender, or disability.[24] Some of the key elementary and secondary programs administered by OESE that relate to educational equity include: the Women's Educational Equity Act program, the Even Start program, Magnet Schools Assistance, Education of Disadvantaged Children Formula Grants to Local Agencies, the Dwight D. Eisenhower Professional Development State Grants Program, and Education for Homeless Children and Youth.[25]

The School Improvement Programs office within OESE administers these and other programs.[26] Such programs address concerns that can benefit an entire student body, ranging from

---

matters involving DOEd; (5) drafts legislation proposals originating in the Department and reviews the legal aspects of proposed or pending legislation; and (6) prepares or reviews briefs, memoranda, and other legal documents for proceedings involving the Department or requested by other government agencies for use in proceedings except for administrative proceedings initiated by the Office for Civil Rights. OGC, 1992 Mission Manual, p. 1.

[18] Office of General Counsel, U.S. Department of Education, information memorandum to DOEd Secretary, June 10, 1980, "Civil Rights Enforcement Between the General Counsel and Assistant Secretary for Civil Rights," p. 1.

[19] Ibid., p. 2.

[20] *See* ibid., pp. 2–3.

[21] *See* ibid., pp. 3–4.

[22] U.S. Department of Education, Administrative Communications System, vol. 1, pt. B, Mission and Organization Manual, OESE/SIP (1995), pp. 1–2.

[23] Pub. L. No. 89-10, 79 Stat. 27 (1965) (codified as amended in scattered sections of 20 U.S.C.).

[24] U.S. Department of Education, *Improving America's Schools Act of 1993: Reauthorization of the Elementary and Secondary Education Act and Amendments to Other Acts*, Sept. 13, 1993, Introduction, p. 1.

[25] U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, p. 49.

[26] Ibid., p. 52.

sponsoring magnet schools and programs, to promoting equal access to all courses (especially advanced mathematics and science), fostering teacher development, and purchasing textbooks.[27] The School Improvement Programs office establishes cooperative relationships with the Office of Educational Research and Improvement to facilitate dissemination of effective practices and to coordinate research activities supported by the Women's Educational Equity Act.[28]

Women's Educational Equity Act Program

The Women's Educational Equity Act (WEEA), originally enacted in 1974 and most recently reauthorized in 1994, seeks to promote educational equity[29] in access to and participation in academic coursework and professional careers for girls and women.[30] The act is also designed to promote equity for women and girls who experience discrimination on multiple bases such as gender and race, ethnicity, limited English proficiency, national origin, disability, or age.[31]

The WEEA program at DOEd addresses perceptions of gender roles based on cultural differences and stereotypes.[32] With a budget of $3 million, the WEEA authorizes grants to develop and support the implementation of equity programs.[33] Public agencies, private nonprofit agencies, institutions, organizations, student groups, community organizations, and individuals may apply for WEEA grants through national competition.[34] Among other requirements, applicants should address how the proposed project promotes the attainment of one or more of the National Education Goals.[35] Applications and proposals are reviewed by a panel of experts in women's programs that represent different geographical areas, racial and ethnic groups, and levels of education.[36] The Department anticipated granting $568,000 in WEEA grants in FY 1999.[37]

WEEA funds support both implementation projects and research and development activities. Allowable implementation project activities include, but are not limited to:

- Training for teachers and other school personnel in gender-equitable teaching and learning practices.
- Leadership training for women and girls.
- School-to-work transition programs and guidance and counseling activities to prepare girls to enter technological careers.
- Activities that enhance opportunities for women and girls who face multiple forms of discrimination (e.g., race and gender).
- The use of textbooks, curricula, and other materials designed to promote gender equity.
- Activities to prevent sexual harassment and violence against women and girls and to en-

---

[27] Ibid.

[28] Ibid.

[29] The Commission defines educational equity for women as: (a) elimination of institutionalized barriers and inequitable educational policies and practices that prevent full and fair participation by women in educational programs and in American society generally; and (b) ability of women to choose freely among benefits and opportunities in educational institutions, programs, and curricula, without limitations based on gender.

[30] Pub. L. No. 93-380, tit. IV, § 408, 88 Stat. 554 (codified as amended at 20 U.S.C. §§ 7231–7238 (Supp. III 1997)).

[31] 20 U.S.C. § 7232(3) (1994). *See also* U.S. Departments of Labor, Health and Human Services, Education, and Related Agencies, Hearings on Appropriations before the Subcommittee on the Departments of Labor, Health and Human Services, Education, and Related Agencies of the House Appropriations Committee, 104th Cong., 1st sess. 67 (1995), p. 796. Men and boys are not prohibited from participating in any programs or activities assisted with the federal funds for the WEEA program. 20 U.S.C. § 7235(e) (1994). *See* chap. 2 for a more detailed discussion of the Women's Educational Equity Act.

[32] 20 U.S.C. § 7234(3) (1994). *See also* Brenda L. Wolff, special assistant for equity, U.S. Department of Education, letter to Frederick D. Isler, assistant staff director, Office of Civil Rights Evaluation, U.S. Commission on Civil Rights, Sept. 3, 1999 (re: request for information) (hereafter cited as Wolff letter), attachment, "The WEEA Program: 1989–1999."

[33] U.S. Department of Education, "FY 1999 Budget Summary: Section A—Elementary and Secondary Education," accessed at <http://www.ed.gov/offices/OUS/Budget99/>. *See also* 20 U.S.C. § 7232(b)(1)(A),(B) (1994).

[34] *See* Executive Office of the President, Office of Management and Budget, *Update to the 1995 Catalog of Federal Domestic Assistance*, 1995, p. 857 (hereafter cited as *Catalog of Assistance*); 20 U.S.C. § 8233(b)(1) (1994).

[35] 20 U.S.C. § 7234(2) (1994).

[36] *Catalog of Assistance*, p. 857. Final decisions on grants are made by DOEd on the basis of the selection criteria found in the application package and statutory considerations, including, to the extent feasible, on the basis of geographic distributions. Special consideration is given to applications submitted by organizations or individuals who have not received assistance under this program. *See* ibid.

[37] DOEd, "FY 1999 Budget Summary."

sure that educational institutions are free from threats to the safety of students and personnel.
- Programs to increase educational opportunities, including higher education and vocational training for low-income women to help them move from welfare to work.[38]

Allowable research and development activities include, but are not limited to:

- Development of nondiscriminatory tests, curricula, textbooks, software, and other educational materials to ensure the absence of gender stereotyping and bias.
- Development of policies and programs to address and prevent sexual harassment and violence to ensure that educational institutions are free from threats to safety of students and personnel.
- Design of innovative strategies and model training programs in gender equity for teachers and other school personnel.[39]

Program funds can also be used for production, maintenance, and dissemination of materials and research on gender equity issues.[40]

The WEEA program also funds the WEEA Equity Resource Center under contract with the Education Development Center, Inc., in Newton, Massachusetts. The WEEA Equity Resource Center provides technical assistance to WEEA grantees and the educational community, publishes and disseminates gender equity materials and products, and promotes national awareness of gender equity issues.[41] Several of the most requested items distributed by the center are related to gender equity in math and science, including the following titles:

- *Gender Discourse and Technology.*
- *Math and Science for the Co-Ed Classroom.*
- *Gender-Fair Math.*
- *Lifting the Barriers: 600 Strategies That Really Work to Increase Girls' Participation in Science, Mathematics, and Computers.*
- *Gender Stereotypes.*
- *Add-ventures for Girls: Building Math Confidence.*[42]

The popularity and demand for these items suggest an awareness of gender inequities and a need for information on improving access to math, science, and technology for women and girls.

TABLE 4.1
WEEA Program Budget, 1992–1998

Fiscal year	Budget appropriation ($)
1989	2,949,000
1990	2,098,000
1991	1,995,000
1992	500,000
1993	1,984,000
1994	1,984,000
1995	3,900,000
1996	0
1997	2,000,000
1998	3,000,000
1999	3,000,000

SOURCE: Brenda L. Wolff, special assistant for equity, U.S. Department of Education, letter to Frederick D. Isler, assistant staff director for civil rights evaluation, U.S. Commission on Civil Rights, Sept. 3, 1999 (re: request for information), attachment, "The WEEA Program: 1989–1999," p. 2.

Funding for the WEEA program has been erratic. The program was funded at $6 million in 1976 and reached a high of $10 million in 1980.[43]

[38] 20 U.S.C. § 7233(b)(2)(A) (1994). Some funds also may be used for programs to increase opportunities for females to enter nontraditional fields, to work in technologically demanding workplaces and, in particular, to enter highly skilled, high paying careers in which women and girls have been underrepresented traditionally. 20 U.S.C. § 7233 (b)(2)(A)(iv) (1994). In addition, funds also may be used for in-school programs to help pregnant and parenting teens remain in school, graduate, and prepare their children for preschool. 20 U.S.C. § 7233(b)(2)(A)(vi) (1994). Moreover, funds also may be used for a variety of activities, including programs to evaluate exemplary model gender equity programs, programs to introduce gender-equitable materials into the classroom, programs to implement nondiscriminatory testing mechanisms, programs to improve the representation of women in school administration, planning and development, and the initial implementation of comprehensive and innovative equity programs. *See* 20 U.S.C. § 7233 (1994).

[39] 20 U.S.C. § 7233(b)(2)(B) (1994).

[40] DOEd, *Biennial Evaluation Report*, pp. 125-2 to 125-3; 20 U.S.C. § 7233(a) (1994).

[41] Wolff letter, attachment, "The WEEA Program: 1989–1999," pp. 2–3.

[42] Ibid., p. 9.

[43] DOEd, *Biennial Evaluation Report*, p. 125-1.

Between 1989 and the present, support has fluctuated, but remained dramatically lower than in the 1970s and 1980s (see table 4.1). A budget of $3 million is insufficient to cover the costs of full funding for all WEEA continuation grants. Thus, the projects may need to seek alternate funding sources, as in FY 1996.[44] Current grantees and educators interested in significantly increasing school-to-work opportunities for minorities, women, and individuals with disabilities claim that if WEEA loses its authorization, opportunities for these students to prepare for careers that are not traditional for their race, gender, or disability will diminish.[45]

OCR's Interaction with OESE

Although OCR is the sole office within DOEd with civil rights enforcement responsibilities, OCR interacts with program offices such as OESE to assist in its work. This interaction stems from program offices sharing information and referrals with OCR. For example, when each applicant for financial assistance under a DOEd program completes its application package, it must sign an assurance that it will comply with civil rights laws. If OESE, in reviewing an application, receives information that an applicant or grantee may not be in compliance with civil rights requirements, it provides OCR with this information with which OCR then can conduct followup activities. If an applicant or grantee requests information or technical assistance on civil rights issues from OESE, OESE will refer that applicant/grantee to OCR.[46] Because the program office's civil rights function is limited to this review of the assurance form, OCR's role in the pregrant review process also is limited.

In addition, OCR reviews regulations proposed by program offices, including selection criteria for civil rights concerns. DOEd's general administrative regulations, which are used by many discretionary grant programs including WEEA, consider how the applicant will ensure eligible project participants are selected without regard to race, color, national origin, gender, age, or disability.[47] However, OCR does not participate with the program offices in establishing specific criteria used to award federal funds or in ensuring equal educational opportunity principles are incorporated into that criteria.

The interaction between OCR and the program offices also entails review of OCR draft regulations and policy documents to ensure programmatic concerns are fully considered in the development of civil rights regulations and policy guidance. When OCR develops regulations or policy guidance, it provides these documents to the appropriate program offices for review prior to final issuance.[48] OESE may obtain data on civil rights compliance when it monitors grantees' projects. If OESE obtains data during its monitoring that indicates an issue of civil rights compliance, it provides that information to OCR for further action, and vice versa.[49]

OCR maintains an active relationship with another office within the Department of Education, the Office of Special Education and Rehabilitative Services (OSERS) and has a memorandum of understanding with that office, which it follows closely.[50] OCR does not have a formal

---

[44] *See* Wolff letter, attachment, "The WEEA Program: 1989–1999," p. 7.

[45] "Equity Programs May Lose All Funds," *Educating for Employment*, vol. 2, no. 1 (March 1996), p. 5.

[46] Susan Craig, assistant general counsel, Division of Educational Equity and Research, Office of the General Counsel, U.S. Department of Education, to Frederick D. Isler, assistant staff director, Office of Civil Rights Evaluation, U.S. Commission on Civil Rights, response to Commission's request for information, Feb. 1, 1996, general attachment no. 1 (hereafter cited as DOEd, Official Response).

[47] 34 C.F.R. § 75.210(c)(5) (1998).

[48] DOEd, Official Response, general attachment no. 1.

[49] DOEd, Official Response, "Office of Elementary and Secondary Education," attachment no. 7.

[50] Jean Peelen, enforcement director, D.C. Metro Office, Office for Civil Rights, U.S. Department of Education, interview in Washington, DC, May 28, 1996, p. 2 (issue contact person for minority students in special education). Based on the memorandum of understanding between OCR and OSERS, they may undertake the following joint activities: technical assistance; investigations; the issuance of findings under the Individuals with Disabilities Education Act (Pub. L. No. 101-476, 104 Stat. 1103 (codified as amended at 20 U.S.C. §§ 1400–1485 (1994)), Section 504 of the Rehabilitation Act of 1973 (Pub. L. No. 93-112 § 504, 87 Stat. 394 (codified as amended at 29 U.S.C. § 794 (1994)); negotiations of remedies for violations found; monitoring of compliance plans; and appropriate enforcement proceedings. U.S. Commission on Civil Rights, *Equal Educational Opportunity and Nondiscrimination for Students with Disabilities: Federal Enforcement of Section 504*, Equal Educational Opportunity Project Series, Volume II, September 1997, pp. 86–87. *See* Madeleine S. Will, Assistant Secretary, Office of Special Education and Rehabilitative Services, and LeGree S. Daniels, Assistant Secretary, Office for Civil Rights, Memorandum of Understanding Between the Office for Civil Rights and the Office of Special Education and Rehabilitative

memorandum of understanding with OESE or the other program offices. The memorandum of understanding between OCR and OSERS clearly serves a number of important objectives, such as investigation of educational agencies; the negotiations of remedies for violations found; the monitoring of compliance plans; the exchange of information; and the opportunity to conduct joint technical assistance activities. This collaboration is extremely useful. In addition, it offers OCR the opportunity for an improved understanding of the pedagogical aspects of educating children with disabilities. It also provides informational resources that assist in developing remedies or offering alternative nondiscriminatory educational criteria and practices to schools. Were OCR to develop a similar memorandum of understanding with OESE, it would accomplish many of the same goals in DOEd's efforts to ensure equal educational opportunity for girls in advanced mathematics and science that the existing memorandum of understanding between OCR and OSERS accomplishes for students with disabilities.

OCR's Title IX Implementation, Compliance, and Enforcement Efforts

Title IX Statute

OCR has enforcement responsibility for Title IX of the Education Amendments of 1972, as amended, which prohibits sex discrimination under any educational program or activity receiving federal financial assistance.[51] Title IX provides that:

> [N]o person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.[52]

Modeled after Title VI of the Civil Rights Act of 1964, Title IX's coverage includes discrimination on the basis of sex against both students and employees of educational institutions. However, it is limited in scope to educational institutions and in coverage to sex discrimination, and therefore, unlike other civil rights statutes, Title IX does not apply uniformly to all recipients of federal financial assistance. Title IX states that its nondiscrimination requirements do not apply to recipients that are religious organizations if the requirements are inconsistent with the religious tenets of the organizations and if the recipients apply for an exemption in writing to the Assistant Secretary for Civil Rights.[53] Title IX also does not apply to educational institutions that are primarily military training institutions or to the membership practices of sororities, fraternities, the YMCA, the YWCA, Girl Scouts, Boy Scouts, Camp Fire Girls, or other single-sex voluntary youth service organizations.[54] Finally, Title IX does not apply to the admission practices of private postsecondary institutions or public postsecondary institutions that have traditionally and continuously limited admission to members of one sex.[55]

OCR's Title IX implementation, compliance, and enforcement activities closely resemble those of Title VI. For example, as with its Title VI enforcement, OCR may deny or discontinue federal assistance to educational programs found in noncompliance with the statute's prohibition against discrimination.[56] In addition, OCR enforces Title IX primarily through the investigation of all timely filed complaints within its jurisdiction and compliance reviews of select recipients.

At the elementary and secondary education levels, Title IX federal court litigation[57] has focused largely on nondiscrimination on the basis of sex in athletic programs,[58] sexual harass-

---

Services, policy codification system document no. 152 (July 29, 1987), p. 2.

[51] 20 U.S.C. § 1681 (1994).

[52] 20 U.S.C. § 1681(a) (1994).

[53] 34 C.F.R. § 106.12(a)-(b) (1998).

[54] *Id.* §§ 106.12–106.14.

[55] *See* 20 U.S.C. § 1681(a)(1)-(9) (1994). The regulations implementing the statute allow elementary and secondary schools to restrict admissions in certain circumstances. 34 C.F.R. §§ 106.11, 106.15(c)-(e), 106.35(b) (1998).

[56] James S. Wrona, "Eradicating Sex Discrimination in Education: Extending Disparate-Impact Analysis to Title IX Litigation," *Pepperdine Law Review*, vol. 21 (1993), pp. 4–5.

[57] OCR's Title IX enforcement activities in elementary and secondary education have involved primarily sexual harassment. *See* Goldbecker interview, p. 2. OCR has few cases involving single-sex schools in elementary and secondary education.

[58] *See* Yellow Springs Exempted Village Sch. Dist. v. Ohio High Sch. Athletic Ass'n, 647 F.2d 651 (6th Cir. 1981); O'Connor v. Bhd. of Educ., 645 F.2d 578 (7th Cir. 1981), *on remand*, 545 F. Supp. 376 (N.D. Ill. 1982); Ridgeway v. Montana High Sch. Ass'n, 633 F. Supp. 1564 (D. Mont. 1986),

ment,[59] and the legality of single-sex educational institutions.[60] However, the statute's protections extend to sex discrimination in all areas of educational programs, both academic and noncurricular.

Title IX Regulations

DOEd's Title IX regulations, published in 1975, implement the statute and provide guidance on the rights and responsibilities under the act.[61] The Title IX regulations were reviewed by Congress and approved by the President, and are much more specific than Title VI regulations in regard to what actions and practices are prohibited. They require that each recipient designate a person or persons to coordinate the recipient's Title IX compliance efforts and establish complaint procedures.[62] Furthermore, the regulations contain detailed notification requirements for recipients.[63] The Title IX regulations attempt to ensure nondiscrimination on the basis of sex in educational programs through provisions that require educational agencies and institutions to take proactive measures in keeping with the statute's prohibition against discrimination on the basis of sex. However, because the statute does not apply uniformly to all recipients of federal financial assistance, the regulations do not contain the specific procedural and due process requirements included in other regulations such as the Section 504 regulations.

The Title IX regulations contain a specific self-evaluation requirement of recipients that has no counterpart in the Title VI regulations. The regulations require all recipients to conduct a self-evaluation to determine their compliance status and, upon consultation with persons with disabilities and other individuals, modify their practices and take such remedial actions as necessary.[64] The regulations, however, require only an initial self-evaluation to be conducted within 1 year of the effective date of the regulations. They do not require recipients to conduct continual, periodic self-assessments.

The Title IX regulations are subdivided into sections addressing discrimination in admission and recruitment, discrimination in educational programs and activities, and employment discrimination in educational programs and activities.[65] Within these sections there are provisions clarifying Title IX's prohibition of discrimination as it applies to elementary and secondary education, higher education, and employment. For example, the regulations address specific topics, such as housing at educational institutions, access to public elementary and secondary schools, counseling, financial aid, marital or parental status, athletics, employment criteria, and job classification and structure. For recipients, beneficiaries, employees, and other individuals affected by federally assisted programs, this specificity assists them in understanding their rights and responsibilities under the federal regulations.

Admissions and Recruitment

The Title IX regulations give several examples as to what constitutes prohibited discrimination in admissions.[66] These include:

- Giving preference to one student over another on the basis of sex (including admitting students based on separate ranked lists by sex).
- Placing numerical restrictions on the number of students of either sex who can be admitted.
- Using tests or other criteria for admission that have an "adverse effect" on the basis of sex, unless such criteria are shown to be educationally valid and other criteria are not available.[67]

---

aff'd, 858 F.2d 579 (9th Cir. 1988), *modified*, 749 F. Supp. 1544 (D. Mont. 1990).

[59] *See* Franklin v. Gwinnett County Pub. Sch., 503 U.S. 60 (1992); Rowinsky v. Bryan Indep. Sch. Dist., 80 F.3d 1006 (5th Cir. 1996); Lillard v. Shelby County Bd. of Educ., 76 F.3d 716 (6th Cir. 1996); Patricia H. v. Berkeley Unified Sch. Dist., 830 F. Supp. 1288 (N.D. Ca. 1993).

[60] *See* Vorchheimer v. School Dist., 532 F.2d 880 (3d Cir. 1976), *aff'd by an equally divided Court*, 430 U.S. 703 (1977); Garrett v. Bhd. of Educ., 775 F. Supp. 1004 (E.D. Mich. 1991).

[61] 40 Fed. Reg. 24128 (1975); 34 C.F.R. pt. 106 (1998).

[62] 34 C.F.R. § 106.8 (1998). *See also* Susan S. Klein, ed., *Handbook for Achieving Sex Equity Through Education* (Baltimore: The Johns Hopkins University Press, 1985), p. 97.

[63] *Id.* § 106.9.

[64] 34 C.F.R. § 106.3(c)-(d) (1998).

[65] *See* 34 C.F.R. pt. 106 (1998).

[66] Recall that the admissions provisions apply only to vocational, professional, graduate, and public undergraduate institutions that have not been traditionally single sex. *Id.* § 106.15(c)-(e).

[67] *Id.* § 106.21(b).

The Title IX regulations proscribe recipients from having admissions policies relating to marital or parental status that differ by sex; from discriminating in admissions based on pregnancy; from treating pregnancy-related disabilities differently from other temporary disabilities; and from making preadmission inquiries about applicants' marital status.[68] Finally, the regulations prohibit recipients from giving admissions preferences to applicants who have attended institutions that are predominantly of one sex, from discriminating on the basis of sex in the recruitment of students, and from recruiting primarily at single-sex institutions.[69]

Educational Programs

The Title IX regulations also prohibit discrimination on the basis of sex within educational programs and related activities. This prohibition applies to "any academic, extracurricular, research, occupational training, or other educational program or activity" operated by a recipient. The regulations provide several examples of prohibited actions, and require recipients to ensure discrimination does not occur in their programs. For example, they allow separate housing and physical education facilities, but require that housing for both sexes be comparable.[70] The Title IX regulations also address particular topics, such as testing,[71] counseling,[72] access to course offerings,[73] and access to schools operated by local educational agencies (public school systems).[74]

For example, the Title IX provisions promote equal access to all course offerings regardless of sex, and they provide as examples course offerings traditionally subject to gender stereotypes, such as health, physical education, industrial, business, vocational, technical, home economics, and music classes.[75] With a few exceptions, the regulations prohibit single-sex classes at all levels of education. They require that a recipient "not provide any course or otherwise carry out any of its educational program or activity separately on the basis of sex, or require or refuse participation therein by any of its students on such a basis."[76] Limited exceptions to this provision allow ability grouping in physical education courses if based on factors other than sex, and permit sex segregation for contact sports, sex education classes, and choruses based on vocal range or quality.[77]

Single-sex elementary and secondary schools generally are permitted by the regulations, but where a local educational agency operates a school for members of one sex only, it must make available to members of the opposite sex, pursuant to the same admissions criteria, comparable courses, services, and facilities.[78] In addition, the regulations proscribe local educational agencies from excluding persons from admission to vocational education institutions on the basis of sex.[79]

Employment Discrimination

Based on the language of the statute, the Title IX regulations contain a blanket prohibition against employment discrimination based on sex by recipients of federal financial assistance.[80] The regulations contain provisions clarifying the prohibition as it applies to employment criteria, recruitment, compensation, job classification and structure, fringe benefits, marital and parental status, advertising, pre-employment inquiries, and sex as a bona fide occupational qualification.[81]

Proving Discrimination under Title IX

A key to ensuring compliance with civil rights laws is understanding what constitutes discrimination. If state educational agencies and school systems understand the elements OCR considers in its complaint investigations and compliance reviews, they can proactively monitor the policies, procedures, and services provided to students to ensure that educational practices are nondiscriminatory. OCR has recognized the importance of educating DOEd recipi-

---

[68] *Id.* § 106.21(c).

[69] *Id.* §§ 106.22, 106.23.

[70] *Id.* §§ 106.32, 106.33.

[71] *Id.* § 106.36(b).

[72] *Id.* § 106.36.

[73] *Id.* § 106.34.

[74] *Id.* § 106.35.

[75] *Id.* § 106.34.

[76] *Id.* § 106.34.

[77] *Id.* § 106.34(b), (c), (e), (f).

[78] *Id.* §§ 106.33, 106.35(b) (1998). *See* chap. 6 for a discussion on single-sex schools.

[79] *Id.* § 106.35.

[80] *Id.* § 106.51.

[81] *Id.* §§106.52–106.61.

ents and beneficiaries on its approaches to proving discrimination. According to Assistant Secretary Norma Cantú, OCR "ha[s] begun to share [its] investigative guidance with the public so that they know what our rules are."[82] OCR has several different approaches to proving discrimination depending on the type of case and issues involved.

In conducting Title IX complaint investigations and compliance reviews, OCR may base a finding of discrimination on a disparate treatment analysis or a disparate impact analysis.[83] These analyses, as applied to Title IX cases, have evolved from the law developed under Title VI and Title VII of the Civil Rights Act of 1964. Disparate treatment under Title IX occurs when the recipient[84] of federal funds takes an adverse action against the complainant because of the complainant's sex.[85] Disparate impact under Title IX occurs when a recipient's facially neutral policy adversely affects one group of a particular sex more than another without an educational justification.[86]

Disparate Treatment

OCR's Title IX regulations prohibit disparate treatment in a variety of activities related to federally assisted educational programs.[87] OCR's Title IX regulations state that in providing any aid, benefit, or service to a student, a recipient under any federally funded program may not, on the basis of sex:

1. Treat one person differently from another in determining whether such person satisfies any requirement or condition for the provision of such aid, benefit, or service.
2. Provide different aid, benefits, or services or provide aid, benefits, or services in a different manner.
3. Deny any person any such aid, benefit, or service.
4. Subject any person to separate or different rules of behavior, sanctions, or other treatment.
5. Apply any rule concerning the domicile or residence of a student or applicant, including eligibility for instate fees and tuition. . . .
6. Otherwise limit any person in the enjoyment of any right, privilege, advantage, or opportunity.[88]

Under a disparate treatment analysis, the complainant must prove that the recipient intentionally discriminated. However, a complainant need not provide direct proof of intentional discrimination and may rely on circumstantial evidence to establish discriminatory intent by inference.[89] Under Title IX, a complainant who alleges intentional discrimination may initially establish a prima facie case of discrimination by demonstrating each of four key elements. First, the complainant must demonstrate that he or she is of a particular sex. Second, the complainant must show that he or she was qualified to

---

[82] Norma V. Cantú, Assistant Secretary for Civil Rights, U.S. Department of Education, interview in Washington, DC, July 30, 1996, p. 4 (hereafter cited as Cantú interview).

[83] *See* 42 U.S.C. § 2000e-17 (1994). *See also* Norma V. Cantú, Assistant Secretary for Civil Rights, Office for Civil Rights, U.S. Department of Education, memorandum to All Staff, "Minority Students and Special Education," policy codification document no. 00291 (July 6, 1995) (citing Guardians Ass'n v. Civil Service Comm'n, 463 U.S. 582 (1983); Castaneda v. Pickard, 781 F.2d 456 (5th Cir. 1986); Georgia State Conferences of Branches of NAACP v. Georgia, 775 F.2d 1403, 1417 (11th Cir. 1985); and Dillon County Dist. No. 1 and South Carolina State Dep't of Educ., No. 84-VI-16 (Civil Rights Reviewing Authority 1987) (policy codification system document no. 180)).

[84] For purposes of this discussion, "recipient" represents any and all possible respondents to a Title IX complaint, such as subrecipients.

[85] International Bhd. of Teamsters v. United States, 431 U.S. 324, 335 n.15 (1977).

[86] Bhd. of Educ. v. Harris, 444 U.S. 130, 151 (1979) (in disparate impact cases in the education context, defendants are required to show an educational necessity instead of a business necessity). *See* International Bhd. of Teamsters v. United States, 431 U.S. at 360–62 and n.46 (establishing Title VII business necessity analysis). *See also* OCR, "Minority Students and Special Education."

[87] 34 C.F.R. § 100.3(b)(1)(i)-(vi) (1998).

[88] 34 C.F.R. § 106.31(b) (1998).

[89] For disparate treatment cases relying on indirect and circumstantial evidence, *see* McDonnell Douglas Corp. v. Green, 411 U.S. 792 (1973); Texas Dept. of Community Affairs v. Burdine, 450 U.S. 248 (1981); and St. Mary's Honor Center v. Hicks, 509 U.S. 502 (1993). For disparate treatment cases relying on direct evidence, *see* Dothard v. Rawlinson, 433 U.S. 321 (1977); and International Union, UAW v. Johnson Controls, Inc., 499 U.S. 187 (1991). The Civil Rights Act of 1991 does not address the burden of proof in disparate treatment cases. The act does, however, address damages in cases of intentional discrimination. Pub. L. No. 102-166, 105 Stat. 1071, 1072 (codified at 42 U.S.C. § 1981a (1994)). In the educational context, *see* Dayton v. Brinkman, 443 U.S. 526, 536 n.9 (1979); Columbus v. Penick, 443 U.S. 449, 464–65 (1979); Milliken v. Bradley, 418 U.S. 717, 725, 745 (1974).

receive the benefits, aid, or services of the federally assisted program. This element can be satisfied by a variety of activities that demonstrate opportunity, such as meeting eligibility requirements or completing appropriate applications. Third, the complainant must demonstrate that he or she was:

1. Denied an opportunity to participate in a federally assisted program because of his or her sex.
2. Limited in his or her ability to participate in a federally assisted program because of his or her sex.
3. Denied access to the benefits or services of a federally assisted program because of his or her sex, and/or
4. Rejected from participating in a federally assisted program because of his or her sex.

Fourth, the complainant must show that the benefits, aid, or services of the federally assisted program remained available or accessible to others of a different sex.[90]

Disparate Impact

OCR can also use the disparate impact theory of discrimination to establish noncompliance with Title IX in cases related to access of girls to advanced mathematics and science classes. Disparate impact cases do not require proof of the recipient's discriminatory motive.[91]

A federal court has held that the disparate impact theory can be used under Title IX.[92] In *Sharif v. New York State Education Department*, the court found that the State Education Department had discriminated against female students in violation of Title IX and the Equal Protection Clause of the 14th Amendment.[93] This case represents the only instance of a court conducting and applying a disparate impact analysis in a ruling addressing civil rights issues under Title IX and the Equal Protection Clause. According to the court:

> [T]his is the first case where female students are seeking to use the federal civil rights statute prohibiting sex discrimination in federally-funded educational programs [Title IX] to challenge a state's reliance on standardized tests. This case also presents a legal issue of first impression: whether discrimination under Title IX can be established by proof of disparate impact without proof of intent to discriminate.[94]

The *Sharif* plaintiffs claimed the State Education Department's sole reliance on the use of the SAT scores for 1989 graduates denied them equal protection of the laws under the 14th Amendment and violated Title IX. The plaintiffs argued, in their Title IX claim, that the practice had a disparate impact on female students,[95] and

---

[90] *See* McDonnell Douglas Corp. v. Green, 411 U.S. 792 (1973). Once the complainant's initial burden has been met, the respondent can provide evidence refuting the complainant's case. While the complainant's initial burden in disparate treatment cases under both Title VII and Title VI has remained consistent, the courts have continued to debate what role the initial burden has in ultimately proving intentional discrimination. In a 1993 Title VII case, the Supreme Court clarified the respective burdens of complainants and respondents once the prima facie case is established. In St. Mary's Honor Center v. Hicks, 509 U.S. 502 (1993), the Supreme Court revisited the precedents established in *McDonnell Douglas Corp. v. Green* and *Texas Dept. of Community Affairs v. Burdine*.

Justice Scalia, writing for the five-justice majority in *Hicks*, held that if the complainant successfully demonstrates a prima facie case of intentional discrimination by direct or circumstantial evidence, a rebuttable presumption of intentional discrimination is created. 509 U.S. at 506–07. According to the Court, the presumption is merely a court-created procedural device that allows a conclusion to be drawn from the asserted facts and shifts the burden of producing evidence to the respondent. However, the complainant always maintains the ultimate burden of persuading the trier of fact that the respondent intentionally discriminated. 509 U.S. at 508.

Once the presumption of intentional discrimination is established, the respondent must produce evidence of a legitimate, nondiscriminatory explanation for the adverse action, and that evidence must rebut the presumption. 509 U.S. at 506–07. The respondent need only present evidence of a legitimate reason, and need not demonstrate that he or she was actually motivated by the nondiscriminatory reasons offered. 509 U.S. at 510–11. If the respondent produces such evidence, then the complainant must be able to show that the nondiscriminatory reasons offered by the respondent were merely a pretext for intentional discrimination. 509 U.S. at 508. According to a majority of the Supreme Court, a complainant cannot demonstrate that the nondiscriminatory reasons were mere pretext unless he or she proves "both that the reason was false, *and* that discrimination was the real reason" for the adverse action. 509 U.S. at 515 (emphasis deleted). To date, the federal courts have not cited *Hicks* in a Title VI or an education case. However, because the earlier disparate treatment cases have been applied consistently to Title VI, it appears that the federal courts will likely follow the recent clarifications.

[91] 431 U.S. at 335–36, n.15.

[92] 709 F.Supp. 345 (S.D.N.Y. 1989).

[93] *Id.* at 348.

[94] *Id.*

[95] *Id.* at 360.

the court agreed. In supporting the plaintiffs' claim of disparate impact, the *Sharif* court relied on "substantial guidance" recognizing that "Title IX was patterned after Title VI of the Civil Rights Act of 1964,"[96] and that "courts examining Title IX questions have looked to the substantial body of law developed under Title VI."[97] Specifically, the *Sharif* court discussed *Guardians Association v. Civil Service Commission*,[98] in which the Supreme Court held that although a violation of Title VI *itself* requires proof of discriminatory intent, a majority agreed that "proof of discriminatory *effect* suffices to establish liability when a suit is brought to enforce regulations promulgated under Title VI, rather than the statute itself."[99] The court's final step in determining that a disparate impact analysis was the appropriate discrimination analysis was a finding that the Title IX implementing regulations, consistent with the "comprehensive reach" of the statute,[100] explicitly prohibit facially neutral practices that create an adverse effect on persons on the basis of sex.[101]

In developing its disparate impact analysis, the court relied on the three-pronged test for proving disparate impact used by the U.S. Supreme Court in Title VII employment discrimination cases.[102] The court observed that this test requires: (1) that the plaintiff show a facially neutral policy resulted in a disproportionate effect; (2) the defendants to prove a "substantial legitimate justification—a 'business necessity'—for its practice"; and (3) that for the plaintiff to prevail, he or she must show either an equally effective alternative practice that has less discriminatory impact or proof that the facially neutral practice is actually a pretext for intentional discrimination.[103]

Relying on precedent in education-related cases, the *Sharif* court analogized the showing of business necessity required of defendants in the employment setting to an "educational necessity."[104] The State Education Department therefore had to show that the use of the SAT as a sole criterion for awarding merit scholarships was an educational necessity. The court found the defendants:

> [F]ailed to show even a reasonable relationship between their practice and their conceded purpose. The SAT was not designed to measure achievement in high school and was never validated for that purpose. Instead, in arguing that the SAT somehow measures high school performance, defendants rely upon anecdotal evidence that the SAT partially tracks what is generally learned in high school Math and English courses. This argument is meritless.[105]

OCR relies on disparate impact analysis in its compliance reviews in a manner similar to that employed by the *Sharif* court. OCR's general investigative approach in disparate impact cases is laid out in Assistant Secretary Cantú's July 6, 1995, memorandum on legal approaches for investigations relating to minorities and special education.[106] The memorandum states that for policies and practices that have a disparate impact on the basis or race or national origin to be permissible, they "must be educationally necessary." The memorandum lays out several steps for OCR investigators to follow in pursuing a disparate impact case. First, the investigator must determine whether there has been "a disproportionate denial of opportunity to benefit from a program."[107] Second, the investigator should determine whether the disproportion is caused by a "neutral policy, process or prac-

---

[96] *Id.* at 360 (quoting Grove City College v. Bell, 465 U.S. 555, 566 (1984)).

[97] *Id.* at 360.

[98] 463 U.S. 582 (1983).

[99] 469 U.S. 287, 293–94 (emphasis added).

[100] *Id.*

[101] *Id.* The court cited to the following Title IX regulation: "A recipient shall not administer or operate any test or other criterion for admission which has a disproportionately adverse effect on persons on the basis of sex unless the use of such test or criterion is shown to predict validly success in the education program or activity in question and alternative tests or criteria which do not have such a disproportionately adverse effect are shown to be unavailable." 34 C.F.R. § 106.21(2) (1998).

[102] *See* McDonnell Douglas Corp. v. Green, 411 U.S. 792 (1973); Griggs v. Duke Power Co., 401 U.S. 424 (1971).

[103] 709 F. Supp. 345, 361.

[104] *See, e.g.*, Bhd. of Educ. v. Harris, 444 U.S. 130 (1979) (declaring "educational necessity" analogous to "business necessity"). *Id.* at 151; Georgia State Conf. of Branches of NAACP v. State of Georgia, 775 F.2d 1403 (11th Cir. 1985) (holding that the defendants had the burden of proving that their practices bore a "manifest demonstrable relationship to classroom education." *Id.* at 1418).

[105] 709 F. Supp. 345, 362.

[106] *See* OCR, "Minority Students and Special Education," pp. 4–5.

[107] Ibid., p. 4.

tice."[108] If not, the investigation proceeds as a disparate treatment case (discussed above). Otherwise, the disparate impact investigation proceeds. The third step in the disparate impact investigation is for the investigators to determine whether a specific aspect of the process led to the disproportion, or whether it is the entire process that is the cause. The fourth step is to consider whether the specific aspect (or the entire process) is educationally necessary.[109] The memorandum states that "[i]f the evidence does not establish that the policy, procedure, or practice is necessary to meet an important educational goal, then it must be eliminated."[110] Even if the investigation finds that the policy is educationally necessary, the investigator must take the fifth step of determining whether an alternative practice exists that the recipient does not use and that is less discriminatory. Although this procedure is outlined specifically with respect to Title VI, it is applicable to Title IX cases and is a guideline for OCR when determining whether disparate impact has resulted from a practice in violation of Title IX.

Title IX Policy, Guidance, and Investigative Procedures

Policy development is an important aspect of civil rights enforcement. Policies should be clearly articulated and formally published. According to Assistant Secretary Cantú, OCR "take[s] the policy process very seriously and tr[ies] to balance [OCR's] agenda."[111] However, she believes the issuance of formal policy in the *Federal Register* is not the only way to assist people. For example, she noted OCR's letters of finding are often used as policy because they are "a clear expression of policy through application to specific facts."[112] Moreover, according to Ms. Cantú, OCR's difficulty in enforcing Title IX and other statutes springs not from the lack of new policy guidance, but from the lack of resources.[113] While the foregoing statements may be true, they evince a narrow concept of the purpose of policy guidance. Policy guidance informs not only recipients and OCR investigators, but also students, parents, faculty members, and administrators, all of whom need to understand their rights and responsibilities under Title IX.

OCR has prepared several documents that provide guidance to its investigators in conducting cases related to girls' access to and participation in advanced mathematics and science in elementary and secondary schools.[114] These documents offer insight into OCR's compliance standards and the investigative approach OCR staff should follow. They indicate OCR has a set of written compliance standards for staff to use uniformly in compliance investigations.

OCR's Investigative Manual

OCR issued a draft investigative manual in August 1994 titled "Underrepresentation of Females and Minorities in Upper-Level Mathematics and Science in Secondary Schools." It was prepared as investigative guidance by a team of OCR staff members with expertise in the area and drawn from throughout OCR.[115] A key compliance document, OCR's investigative guidance on the underrepresentation of girls and minorities in advanced mathematics and science programs has never been issued formally by OCR and remains in draft form. OCR's draft investigative guidance provides comprehensive guidance to investigators, including the legal standards investigators should apply.

Because the manual is designed specifically to address underrepresentation in upper-level math and science courses, it begins by defining the parameters around which "upper-level" courses are classified for investigative purposes. OCR states:

---

[108] Ibid.

[109] *See* U.S. Department of Education, Office for Civil Rights, Investigative Manual: Underrepresentation of Females and Minorities in Upper-Level Mathematics and Science in Secondary Schools, draft, August 1994, pp. 6–8 (hereafter cited as OCR, Draft Investigative Manual, "Females and Minorities in Math and Science").

[110] *See* OCR, "Minority Students and Special Education," p. 5.

[111] Cantú interview, p. 3.

[112] Ibid., pp. 3–4.

[113] Ibid., p. 4.

[114] OCR has also developed a technical assistance document for educational institutions on how to comply with Title IX in math and science programs. *See* U.S. Department of Education, Office for Civil Rights, "What Schools Can Do to Improve Math & Science Achievement by Minority and Female Students," undated brochure. For further discussion of this brochure, *see* "Technical Assistance, Outreach, and Education," section in this chapter.

[115] *See* OCR, Draft Investigative Manual, "Females and Minorities in Math and Science."

Upper-Level Mathematics and Science Courses may differ from state to state and district to district, so a region may have to determine which of a district's courses are "upper-level." All advanced placement and honors courses in mathematics (calculus, trigonometry) and science (biology, chemistry, and physics) come under the upper-level umbrella.[116]

Thus, nongeneral, applied, and third-level courses such as algebra III, calculus, analytical geometry, probability and statistics, astronomy, and physics would be considered upper-level courses.[117]

Although it recognizes that "developing sound investigative approaches to the issue presents a daunting challenge," the draft investigative manual provides step-by-step instruction on targeting recipients for compliance reviews, investigative approaches to use, and applicable legal standards.[118] In the absence of formal OCR policy specifically on the underrepresentation of girls in advanced mathematics and science, OCR developed the investigative manual by drawing analogies and information from other OCR policies and guidance.[119]

Site Selection for Compliance Reviews. In its draft guidance, OCR has stated, "The ultimate goal in selecting schools [and] districts for compliance reviews is to get those that have some indicator of compliance problems and thus are more likely to operate their upper-level/track mathematics and science programs in a manner that discriminates against females and minorities."[120] Generally, OCR would expect the number of qualified students in any program to be proportionate to their enrollment across sex or race/color lines.[121] The guidance encourages investigators to target schools for maximum impact.[122] Accordingly, to justify a compliance review of a particular school district, an investigator first must detect indicators of potential compliance problems, such as statistical information that girls or women are underrepresented in advanced mathematics and science programs as compared with their general enrollment numbers.[123]

Investigative Process. In the context of girls in upper-level mathematics and science, OCR will first determine if policies and practices of a particular school district result in girls being treated differently than boys or have a separate impact on girls' participation in upper-level mathematics and science courses.[124] Disparities in enrollment do not necessarily violate Title IX, but are used by OCR staff to justify further investigation. If statistically significant disparities are found, the school district must explain the statistical disparities.[125] OCR then examines district and school policies and practices that affect student entry into these courses to determine whether they discriminate against the underrepresented group.[126] However, once OCR determines significant statistical disparities, the school district usually concedes that there is a problem, and OCR negotiates a remedy to improve minority and female enrollment.[127]

When investigating a school district's student placement practices for potential Title IX violations, OCR analyzes three primary areas: en-

---

[116] Ibid., pp. 3–4.

[117] Ibid., p. 4.

[118] Ibid., p. 1.

[119] Ibid., p. 2. OCR identifies the following documents used in developing the guidance manual: the Draft Ability Grouping Investigative Procedures Guidance, dated Mar. 14, 1991; Investigators Manual for Conducting Compliance Reviews of In-School Student Assignment Practices (In-School Segregation), dated Apr. 30, 1981; Policy Update on Schools' Obligations Toward National Origin Minority Students with Limited-English Proficiency (LEP students), dated Sept. 27, 1991; Draft Memorandum on Burden Shifting, dated Dec. 30, 1993; Draft Investigative Manual for Determining Discrimination and Denial of Services on the Bases of Race, Color, National Origin, Sex and Handicap in Vocational Education Programs, dated Dec. 20, 1979; Region IX Model IP: ESED Vocational Education Reviews, dated Jan. 19, 1988; Technical Assistance Resources package on Elementary and Secondary Education Mathematics and Science Courses, dated Mar. 29, 1993; Draft OCR Investigative Guidance (on procedures to assess testing and assessment), dated Feb. 25, 1994; and the OCR technical assistance brochure, "What Schools Can Do to Improve Mathematics & Science Achievement by Minority and Female Students."

[120] OCR, Draft Investigative Manual, "Females and Minorities in Math and Science," p. 4.

[121] Ibid.

[122] Ibid.

[123] Ibid.

[124] Ibid., p. 6.

[125] Steve Deering, David Rolandelli, and Louise Bonanova, Office for Civil Rights, Region IX, U.S. Department of Education, telephone interview, June 25, 1996 (hereafter cited as Deering et al. interview).

[126] John Palomino, letter to Mac Bernd, superintendent, Newport-Mesa Unified School District, Newport Beach, CA, Jan. 26, 1996 (OCR docket no. 09-95-5005) (hereafter cited as Palomino letter, Jan. 26, 1995).

[127] Deering et al. interview.

rollment patterns of girls in mathematics and science; the criteria for placement in advanced classes; and the school district's monitoring of student progress in those courses.[128] Examining enrollment patterns requires OCR to determine whether a district uses academic tracks or ability grouping practices, or if there are sequences of courses necessary for placement in advanced mathematics and science courses.[129] Once OCR determines what placement practices are being used, it then determines whether any mathematics or science class is racially or gender identifiable.[130]

OCR defines underrepresentation of girls in upper-level mathematics and science under Title IX by applying the definition developed under its Title VI ability grouping guidance.[131] To make this determination, OCR evaluates whether the placement of students in upper-level mathematics and science courses results in gender-identifiable classrooms. Gender-identifiable classrooms exist when appropriate statistical techniques demonstrate that a disproportion of boys to girls could not have reasonably occurred by chance.[132] Generally, gender-identifiable classrooms have a statistically disproportionate number of students of one gender compared with the gender composition of the grade level, th science or mathematics courses, the entire school population, or the population of the district, depending on the nature of the investigation.

OCR uses a rule of thumb of 20 percent as a starting point to determine if the disproportion is gender identifiable—if the difference between the percentage of all students who are girls and the percentage of students in a particular mathematics class who are girls is more than 20 percentage points, then OCR considers the class to be gender identifiable.[133] However, if the student population is small, or other factors are involved, OCR investigators may find a gender-identifiable classroom at a 10 percent level as long as the difference is still statistically significant.[134] OCR then uses statistical techniques to show that the gender-identifiable classroom was unlikely to have occurred by chance.[135] If OCR finds no underrepresentation in advanced math and science courses, it may administratively close the compliance review unless special circumstances exist.[136]

Typically, in addition to identifying statistical disparities, OCR will also review whether electives or prerequisites conflict with enrollment for advanced mathematics and science classes. For instance, OCR will determine if a required mathematics or science prerequisite is offered during the same period as a program geared toward girls, or to see if girls are taking the prerequisites too late in secondary school. The latter is of concern because girls who are enrolled in prerequisites late in secondary school may be precluded from taking upper-level mathematics or science courses.[137]

If OCR finds disparities in upper-level mathematics and science enrollment, it then examines enrollment proportions in the prerequisite courses. OCR's investigative manual states:

> Once OCR has determined which upper-level mathematics and science courses are significantly disproportionate, it should analyze all prerequisite course enrollments, by either race or gender, to determine whether females, minorities, and/or limited-English proficient students have taken prerequisite courses at different rates. If the percentage of female, minority, and limited-English proficient students who took the prerequisite courses is not significantly different from the percentages of these students in the upper-level

---

[128] OCR, Draft Investigative Manual, "Females and Minorities in Math and Science."

[129] Ibid., p. I-1.

[130] Ibid.

[131] OCR, Draft "Ability Grouping Investigative Procedures Guidance," p. 2.

[132] Ibid., p. 3.

[133] In the Matter of Maywood School District #89, No. S-125, Secretary's final decision, May 22, 1990, p. 9; Richard D. Komer, Deputy Assistant Secretary for Policy, Office for Civil Rights, U.S. Department of Education, memorandum to OCR Regional Civil Rights Directors, "Ability Grouping Investigative Procedures Guidance," draft, Mar. 14, 1991, p. 2.

[134] If a class is not gender identifiable under the 20 percent rule, OCR investigators are instructed to conduct a z-test of proportions to determine whether the class contains a disproportionate number of students of one gender. *See* OCR, Draft "Ability Grouping Investigative Procedures Guidance," attachment, Draft "Investigative Plan Ability Grouping Compliance Review," p. 4. *See also* Greg Martonik, equal opportunity specialist, Office for Civil Rights, Region III, U.S. Department of Education, telephone interview, June 18, 1996.

[135] OCR, Draft "Ability Grouping Investigative Procedures Guidance," p. 2.

[136] OCR, Draft Investigative Manual, "Females and Minorities in Math and Science," p. 7.

[137] Ibid., p. I-2.

course(s), OCR will generally treat any upper-level underrepresentation as educationally justified. OCR will, however, carefully examine whether students were improperly excluded from the prerequisite courses.[138]

If OCR finds significant statistical disparities in a district's mathematics or science programs, it then analyzes the district's policies and placement procedures for possible discriminatory effects.[139] In examining the placement criteria for mathematics and science courses, OCR must:

- Determine the criteria by which students are assigned to mathematics and science courses or tracks, and if the school district accounts for gender and minority status in such assignments.
- Determine whether the criteria for placement in such programs have the effect of disproportionately excluding students from upper-level mathematics and science on the basis of race or gender.
- Review any placement policies or procedures used by the school district.
- Determine whether testing instruments used for placement have been validated for the population being tested, have cultural or gender bias, and are being used consistently and appropriately for all students.
- Determine whether teacher recommendations or other subjective criteria are factors in placement decisions.
- Determine whether high-ability female and minority students are underrepresented relative to other students.[140]

OCR also examines the methods used by a school district to monitor the progress of students placed in advanced mathematics and science courses. OCR must:

- Determine whether a school district has policies and procedures that address the issue of inter-track or inter-ability group transfer.
- Determine whether minority and female students are transferred to higher or lower mathematics or science ability groups consistent with the school district's policies.
- Determine if female and minority students have the same mobility between academic groups as other students.
- Determine whether female and minority students are periodically retested to predict success in upper-level mathematics and science courses.
- Determine whether female and minority students have a higher attrition rate from upper-level mathematics, science, and prerequisite courses than other students.[141]

The draft investigative guidance recommends all mathematics and science compliance reviews look at school districts' student placement and their counseling and guidance procedures.[142] Appendices to the manual provide guidance on the types of data investigators will need to collect during mathematics and science compliance reviews[143] and possible remedial steps to be taken by districts found in noncompliance.[144]

In each of the areas covered in the manual, the types of information and analysis necessary to make a case of discrimination based on disparate impact or disparate treatment are discussed.[145] In investigating Title IX cases under the disparate treatment theory,[146] OCR analyzes the underrepresentation issue to determine whether there is any evidence of differential treatment that adversely affects girls' enrollment in mathematics and science courses.[147] Specifically, OCR investigators are directed to ascertain whether the school or school district engages in steering by counselors, offers discriminatory promotional materials, or provides different course offerings and/or computer and lab assistance in gender-identifiable classes or

[138] Ibid., p. 7.

[139] Ibid., pp. 6–7.

[140] Ibid., pp. I-5, I-6.

[141] Ibid., pp. I-7, I-8.

[142] OCR, Draft "Ability Grouping Investigative Procedures Guidance," p. 2.

[143] *See* OCR, Draft Investigative Manual, "Females and Minorities in Math and Science," appendix A, "Sample Data Needs."

[144] Ibid., appendix B, "Sample Assurances."

[145] *See* ibid., pp. 4–9. *See above* for a discussion of the disparate treatment and disparate impact theories.

[146] *See* OCR, Draft Investigative Manual, "Females and Minorities in Math and Science," pp. 8–9.

[147] Ibid., p. 8.

schools.[148] OCR staff also must assess whether the school or school district consistently applies specific criteria in determining upper-level mathematics and science placement. The manual directs OCR investigators to review standardized test scores to determine if girls who have high scores on the tests are being enrolled in upper-level mathematics and science courses at the same rate as boys who have similar scores.[149] Finally, the manual directs staff to investigate any subjective criteria used to place students in upper-level mathematics and science courses. In this regard OCR states:

> If subjective factors, such as teacher and/or guidance counselor judgments, are used in the placement of students in upper-level courses, decision-makers must be given guidance on the factors they should use in exercising those judgments. If they find that consistent application of the criteria would result in an inappropriate placement in a particular case, they should be able to provide an explanation for this result.[150]

OCR will find a violation of Title IX if the disparate treatment adversely affects the enrollment of females in upper-level mathematics and science courses and if it is not the result of a legitimate, nondiscriminatory action on the part of the recipient.[151]

The draft manual provides additional, specific guidance on the use of disparate impact analysis. In this type of analysis, OCR's concern is based primarily on the statistical representation of girls and minorities in mathematics and science courses.[152] OCR also evaluates achievement levels as they relate to participation in or access to advanced courses in certain circumstances.[153] For example, if a certain grade is required as a prerequisite for a course, OCR would look to see if students being placed in that particular class had the required grades, or to see if qualified students were not being placed. In addition, OCR's investigations may include evaluating disparities in facilities, gender bias in teaching practices, and opportunities to achieve across all course levels.[154]

The burden of identifying a particular practice causing the disparate impact lies with OCR.[155] Practices or policies that may have a disparate impact against females in upper-level mathematics and science courses are usually identified through onsite visits, and after thoroughly analyzing data requested from the district or school.[156] OCR generally will inform the school district of the particular practice causing the disparity before requiring a school district to provide an explanation. Once OCR has established a prima facie case identifying significant disparities in girls' enrollment in upper-level mathematics and science courses, the school district must show that the underrepresentation is justified by an educational necessity.[157] If the school district cannot show educational justification, OCR can find the school district in violation of Title IX.[158]

Resource Guidance

OCR has put together informal resource guidance to assist its staff in investigations relating to underrepresentation of girls and minorities in mathematics and science. In its Resource Guidance Collection, OCR has developed a Title IX manual, similar to its manuals for other civil rights statutes, such as Section 504/Title II and Title VI.[159] The resource guidance briefly summarizes requirements of Title IX that relate to underrepresentation of girls in mathematics and science, including the Title IX provisions on appraisal and counseling materials, testing instruments, internal control, and disproportionate classes. It provides abstracts of relevant research reports on girls and minorities in mathematics and science.

These abstracts are useful in encouraging OCR investigators to become familiar with edu-

---

[148] Ibid.

[149] Ibid., p. 9.

[150] Ibid.

[151] Ibid., p. 8.

[152] Robert Ford, team leader for mathematics and science, Philadelphia Enforcement Office, Office for Civil Rights, U.S. Department of Education, interview, June 11, 1996, p. 4 (hereafter cited as Ford interview). *See also* discussion below on OCR's investigative process.

[153] Goldbecker interview, p. 3.

[154] *See* ibid., pp. 2, 3.

[155] Ford interview, p. 3.

[156] Ibid.

[157] OCR, Draft Investigative Manual, "Females and Minorities in Math and Science," p. 7.

[158] Ibid.

[159] *See* U.S. Department of Education, "Resource Guidance on Underrepresentation of Girls and Minorities in Mathematics and Science" (selected excerpts as retrieved from OCR's Electronic Library—file name: HQ960401.pdc).

cational research on girls' access to and participation in advanced mathematics and science. In addition to these research abstracts, the resource guidance recommends educational strategies to increase the effective participation of female and minority students in mathematics and science. It also contains sections on federal and model programs used by school districts to increase participation. These sections can be particularly useful in providing OCR's investigators with the knowledge they need to assist school districts in remedying discrimination and promoting equal educational opportunity. If it were updated regularly, the resource guidance could be an extremely beneficial resource for OCR staff in conducting cases related to girls' access to and participation in advanced mathematics and science.

OCR's Enforcement Efforts

Compliance Reviews and Complaint Investigations

Few of OCR's Title IX cases have been related to girls' access to and participation in advanced mathematics and science.[160] For example, in FY 1998, OCR received 545 complaints (11 percent of its total receipts) charging violations of Title IX. These complaints covered pregnancy and parenting; interscholastic or intercollegiate athletics; sexual harassment; and gifted and talented programs.[161] Further, the Commission's review of OCR's Electronic Library found that since 1994 OCR has conducted only a handful of compliance reviews and received only a few complaints related specifically to girls' access to and participation in advanced mathematics and science education. Several OCR complaint investigations have focused on issues related to separate mathematics and science classes for girls and the use of tests that unintentionally discriminate against girls.[162]

In its compliance reviews on underrepresentation of girls and minorities in advanced mathematics and science classes, OCR has examined a school district's student enrollment patterns to determine whether girls or minorities were underrepresented in advanced mathematics and science classes or if there were gender or racially identifiable classrooms. In each case, OCR ultimately found that girls were not underrepresented in advanced mathematics and science classes and that no classrooms were gender identifiable. Based on these findings, OCR closed its review with respect to Title IX compliance. Closing these investigations is consistent with OCR's stated enforcement strategy to use its limited compliance review budget to investigate only those programs where there are indications of a problem—i.e., where women or girls are underrepresented in advanced mathematics or science programs.

Although OCR has conducted few Title IX investigations with respect to math and science classes, it has performed significantly more under Title VI. Because of the similarity in the requirements and investigative methods of Titles IX and VI, a look at the Title VI investigations provides an example of how OCR might proceed with a Title IX case. In three cases in which OCR deemed there was no violation of Title IX, OCR found both male and female minority students were underrepresented in advanced mathematics and science classes, and hence OCR continued to pursue its investigation with respect to compliance with Title VI. For instance, in its review of Santa Barbara (California) High School District, OCR's letter of finding indicated OCR's analysis of enrollment data provided by the district "did not disclose that female students were underrepresented in proportion to their numbers in the school population or that classes were identifiable by gender. Accordingly, OCR did not have reason to further investigate the issue under Title IX."[163] However, because OCR found that Latino students "were significantly underrepresented in a number of upper level mathematics and science courses at all sites across the District,"[164] OCR

---

[160] OCR, *Fiscal Year 1998 Annual Report to Congress*, pp. 20–23; OCR, *Office for Civil Rights Fiscal Year 1997 Annual Report to Congress*, pp. 10–12; OCR, *Office for Civil Rights Fiscal Year 1996 Annual Report to Congress*, pp. 3–6; OCR, *Office for Civil Rights Fiscal Year 1995 Annual Report to Congress*, pp. 3–5.

[161] OCR, *Office for Civil Rights Fiscal Year 1998 Annual Report to Congress: Guaranteeing Equal Access to High-Standards Education*, pp. 20–23.

[162] *See* chap. 4 for a discussion on testing; *see also* discussion on single-sex classes, chap. 6.

[163] John Palomino, letter to Michael Caston, superintendent, Santa Barbara High School District, Santa Barbara, CA, July 28, 1995 (OCR docket no. 09-95-5007), p. 2 (hereafter cited as Palomino letter, July 28, 1995).

[164] Ibid., p. 2.

continued to pursue its Title VI investigation with respect to underrepresentation of minority students in advanced mathematics and science classes.

OCR reviewed data provided by the district and interviewed administrators, teachers, counselors, and students "to identify possible factors that could be contributing to the disparate enrollment." OCR identified a number of possible factors, including "lack of staff development and training," "insufficient training and numbers of counselors," "low expectations by staff of Latino student performance," "insufficient efforts to encourage Latino parent involvement," "unequal distribution of staff resources," and de facto tracking of Latino students through permissive staff assignments.[165] To assist the school district in resolving the issues raised in this review, OCR arranged for the Southwest Center for Educational Equity to work with the district and OCR to develop a comprehensive plan "to increase significantly underrepresented minority student enrollment in upper level mathematics and science courses."[166] The district signed a voluntary resolution agreement agreeing to develop and implement the comprehensive plan. OCR agreed that implementation of the plan would constitute compliance and stated its intention to monitor implementation of the plan.[167]

In a similar case in the Newport-Mesa (California) Unified School District, OCR again found "the data showed that female students were not underrepresented [in upper-level mathematics and science courses]. Accordingly, OCR did not have reason to investigate further the issue of access to these courses under Title IX."[168] As in the Santa Barbara case, OCR found Hispanic students were underrepresented in advanced mathematics and science classes:

> Hispanic and LEP students were significantly overrepresented in most basic skills (non-college preparatory) mathematics and science courses and were underrepresented in many college preparatory and upper level mathematics and science courses, and this was true to varying degrees at all District intermediate and high school sites. OCR found that on a District-wide basis, the disproportions were statistically significant in a number of subjects.[169]

Investigating the Title VI case further, OCR conducted onsite visits at several high schools and an intermediate school and interviewed district and school administrators, counselors, mathematics and science teachers, and students. OCR found a number of problems, including large caseloads for counselors, low expectations on the part of counselors and teachers for Hispanic students and students with limited English proficiency, lack of language support in mathematics and science classes for students with limited English proficiency, and inconsistent efforts to conduct outreach to parents.[170] OCR concluded that "in general, the District and individual school sites have not addressed the issue of underrepresentation in a systematic manner."[171] After discussing its concerns with the district, OCR and the district worked together to develop a resolution plan. The comprehensive plan adopted by the district included:

> [A] review of the articulation and placement process; the issuance of District guidance on placement; steps to improve the preparedness and participation of minority students in the full progression of math and science courses at grade level; attendance and retention, course scheduling, services to LEP students, materials and supplies, training for administrators, counselors and teachers, and parent outreach and information. There also are provisions for monitoring and evaluation of the plan and reporting to OCR.[172]

As in the Santa Barbara case, OCR agreed implementation of the plan would constitute compliance with Title VI and stated it would monitor implementation of the plan.[173] OCR has also conducted a compliance review of the Sequoia Union High School District in Redwood City, California, with similar results and a review of the Paducah Independent School District in Paducah, Kentucky, that did not find underrepresentation of either girls or minorities.[174]

---

[165] Ibid.

[166] Ibid., p. 3.

[167] Ibid.

[168] Palomino letter, Jan. 26, 1995.

[169] Ibid., p. 2.

[170] Ibid., pp. 2–3.

[171] Ibid., p. 2.

[172] Ibid., pp. 3–4.

[173] Ibid., p. 4.

[174] Libby Koval, case resolution director, Region VII, Office for Civil Rights, U.S. Department of Education, letter to Donald Sparks, interim superintendent, Paducah Independ-

Letters of Finding

OCR's written instruments relating to enforcement activities, such as letters of finding based on compliance reviews or complaint investigations and negotiated resolution agreements, provide a case-by-case perspective on how OCR communicates to states and local school districts the legal standards on which it relies in conducting its Title IX enforcement activities. The analyses of compliance standards enunciated by OCR in its letters of finding should be thorough, clear, precise, and detailed.

There are several important reasons why it is practical for OCR to focus carefully and systematically on ensuring clarity and thoroughness in the preparation, development, and execution of its letters of finding. First, OCR's letters of finding are the most important written contact between OCR and the local school districts whose efforts to comply with Title IX's nondiscrimination prohibition OCR evaluates. Second, OCR can present in its letters of finding important information such as a detailed recitation of the legal and policy background of Title IX as it relates to specific compliance issues and to Title IX compliance generally.

In providing such information in letters of finding, OCR has an opportunity to disseminate to state and local school district officials, in a detailed and thorough fashion, the basis for the civil rights obligations Congress created in Title IX. Importantly, if OCR presents the information in its letters of finding in a thorough and detailed manner, this information can in turn provide full awareness and understanding among school officials, parents, and students as to the basic importance and continuing relevance of Title IX's prohibition against discrimination on the basis of sex.

Finally, it is important for OCR to use its letters of finding as a means of helping school officials and stakeholders in the school community, particularly parents and students themselves, to recognize that Title IX's legal obligation derives from the larger civil rights theory of equal protection of the laws. Title IX's legal obligation encompasses crucial elements of equal protection theory as it has been applied by Congress, the courts, and the executive agencies in the context of classifications based on sex. These elements include the policies of equal access and effective or equal participation, and equal educational opportunity.[175]

Despite the importance of letters of finding, a review of OCR's available Title IX case letters reveals that OCR has failed to provide recipients

---

ent School District, Paducah, KY, re: case no. 07-94-5012, Mar. 28, 1995 (hereafter cited as Koval letter, Mar. 28, 1995).

[175] Congress has articulated its purposes and findings relating to gender equity in the Women's Educational Equity Act. The act states as one of its purposes: "to provide financial assistance to enable educational agencies and institutions to meet the requirements of Title IX of the Educational Amendments of 1972. . . ." 20 U.S.C. § 7232(2) (1994).

The act's findings relating to the provision of gender equity in schools state the following: "Federal support should address not only research and development of innovative model criteria and teaching and learning strategies to promote gender equity, but should also assist schools and local communities implement gender equitable practices; . . . Federal assistance for gender equity must be tied to systemic reform, involve collaborative efforts to implement effective gender practices at the local level, and encourage parental participation. . . ." 20 U.S.C. § 7231(b)(5),(6) (1994).

In the context of equal protection theory as applied to classifications based on sex, Congress has provided its clearest statement of the meaning of "equal educational opportunity" as it applies to sex in the Equal Educational Opportunities Act of 1974. The act's nondiscrimination provisions are enforced by the U.S. Department of Justice. Congress declared as its policy in the Equal Educational Opportunities Act that: "All children enrolled in public schools are entitled to equal educational opportunity without regard to race, color, sex or national origin . . ." 20 U.S.C. § 1701(a)(1) (1994).

However, it is only in the context of overcoming language barriers that Congress in the Equal Educational Opportunities Act developed a substantive meaning for equal educational opportunity. In the context of requiring schools to overcome language barriers, the Equal Educational Opportunities Act provides that: "No State shall deny equal educational opportunity to an individual on account of his or her race, color, sex, or national origin, by . . . (f) the failure by an educational agency to take appropriate action to overcome language barriers that impede equal participation by its students in its instructional programs." 20 U.S.C. § 1703(f) (1994).

In this language, the statute seems to indicate that equal educational opportunity has been afforded if it can be determined that the school has allowed the student "equal participation." However, the equal participation standard is itself vague and appears to apply only in the context of language barriers, although the classifications of race, color, national origin, and sex, may be the basis for a denial of equal educational opportunity. If Congress amended the statute to require "equal participation" beyond the language context, for example, in such areas as a prohibition against the denial of equal participation on the basis of sex, including the quality of participation, such a standard could be applied to mathematics and science education. This statute could then be used to strengthen federal civil rights protection by adding an equal protection theory to work in tandem with Title IX's nondiscrimination prohibition.

with a thorough analysis of OCR's Title IX policies relating to the participation of girls in mathematics and science education.[176] In general, OCR's letters of finding addressing Title IX compliance relating to sex discrimination, equal access, effective participation, and equal educational opportunity for girls in mathematics and science education provide a brief summary of the statute and its requirements. For example:

> OCR is responsible for enforcing, among other civil rights statutes, Title IX of the Education Amendments of 1972 and its implementing regulation at 34 C.F.R. Part 106, which prohibit recipients of Federal financial assistance from the Department from discriminating on the basis of sex in education programs or activities. The District is a recipient of Federal financial assistance from the Department, and therefore, must comply with the regulation implementing Title IX.[177]

The above text provides the school district with a summary of the legal underpinnings of OCR's Title IX enforcement policy. However, this summary does not provide any information on the specific content and requirements of the Title IX regulations to which it refers, nor does it indicate whether there are any relevant regulatory provisions for this compliance review.

Technical Assistance, Outreach, and Education

Promising Practices and Models

OCR has adopted the innovative practice of putting together issue area teams to research and develop "promising programs and practices" documents in its high-priority areas. The promising practices documents generally are prepared by teams of issue-area experts, comprising regional and headquarters staff. When completed, the final written product is distributed by OCR's headquarters office to each of the regional enforcement offices. OCR's headquarters serves as the clearinghouse for this information.[178]

The promising practices documents describe educationally valid models that have been implemented in school districts across the country and promote equal educational opportunity in the issue areas. However, OCR does not make determinations on educational validity because it does not consider itself an expert on educational issues.[179] Instead, OCR relies on external educational experts and consultants for information on the validity of educational practices.

OCR's promising practices documents are designed for school districts as part of OCR's technical assistance efforts as well as for OCR staff to use as guides in developing remedial plans for school districts not in compliance with civil rights statutes. Promising practices or models that work are useful ways for OCR to provide districts with information on educationally sound programs and what it takes to implement them.[180]

In April 1996, OCR released a promising practices document titled "Access for Women and Minorities to Mathematics and Science Programs and Gifted and Talented Education Programs."[181] OCR emphasizes this technical assistance document is "primarily intended to be a starting point to help districts with an underrepresentation problem see what has been done and what can be done and to give them potential contacts to explore appropriate strategies."[182] In addition, OCR notes that its Title IX policy "allows school districts broad discretion in devising ways to ensure equal educational opportunity for minority and female students,"[183] and cautions that such "programs and practices are

---

[176] *See, e.g.*, Koval letter, Mar. 28, 1995; John Palomino, regional director, Region IX, Office for Civil Rights, U.S. Department of Education, letter to Merle D. Fruehling, superintendent, Sequoia Union High School District, Redwood City, CA, re: case no. 09-95-5009, Mar. 30, 1995; Palomino letter, July 28, 1995; Palomino letter, Jan. 26, 1996.

[177] Koval letter, Mar. 28, 1995, p. 1.

[178] *See* Lee Nell, chief regional attorney, Philadelphia Enforcement Office, Office for Civil Rights, U.S. Department of Education, telephone interview, p. 19.

[179] *See* Cantú interview, p. 6; Susan Bowers, senior enforcement director, Office for Civil Rights, U.S. Department of Education, interview in Washington, DC, May 28, 1996, p. 5.

[180] Cathy Lewis, acting senior enforcement officer for the western part of the United States, Office for Civil Rights, U.S. Department of Education, interview in Washington, DC, June 14, 1996, p. 5.

[181] U.S. Department of Education, Office for Civil Rights, "Promising Programs and Practices: Access for Women and Minorities to Mathematics and Science Programs and Gifted and Talented Education Programs," April 1996. DOEd's Region VII submitted this document as part of its response to the U.S. Commission on Civil Rights information request of June 6, 1996.

[182] Ibid., Introduction, p. 1.

[183] Ibid., p. 2.

not endorsed by OCR as models for compliance with Title VI or Title IX."[184]

The document identifies programs and practices developed and implemented by states and local educational agencies, colleges, and other groups and organizations to address the problem of underrepresentation of girls and women in advanced mathematics and science education.[185] It states the programs and practices "represent a wide variety of strategies that can be used to address the underrepresentation issue"[186] and illustrate "effective ways to meet the educational needs of minorities and women."[187]

The document provides brief descriptions of promising programs ranging from "small-scale efforts to multi-university consortia" representing many areas of the country.[188] It identifies contact persons and details evidence of program success.[189] For example, one of the programs identified, the Mathematics and Science Education Network in North Carolina, targeted to middle, junior high, and high school minority students, states as its goal:

> To increase the number of students from historically underrepresented groups (minorities and females) who are interested in and prepared to pursue mathematics and science study at the college level.[190]

Its ultimate objective is to increase the number of underrepresented students moving into science, technology, engineering, and teaching careers. The Mathematics and Science Education Network program includes in its description that its teachers receive "intensive instruction on attracting and retaining minority and female students in mathematics and science, and in establishing bias-free classrooms."[191] This program cites as evidence of success that:

> Of the 1993–94 participants, 57 percent of the middle school students and 59 percent of the high school students expressed career interests in fields requiring mathematics or science backgrounds . . . Of those known to be enrolled in college, students majoring in mathematics- or science-related fields ranged from 44 percent of 1991 graduates to 73 percent of 1993 graduates. [The Mathematics and Science Education Network's] overall evaluative research indicates a significant positive impact on participating students.[192]

Like each of the 11 programs described in this document as promising practices, the Mathematics and Science Education Network program focuses on students who are members of racial, color, and national origin minorities as well as female students. Since the statistics provided by the program do not indicate a breakdown between girls and boys it is impossible to determine from the program whether girls have been influenced positively to participate in advanced mathematics and science education and pursue related college majors. Similarly, none of the programs described in the promising practices document focuses solely on addressing the unique educational needs of female students seeking to study a mathematics or science major in college.

Technical Assistance Brochure

OCR created a technical assistance brochure to assist schools in complying with civil rights requirements and promoting equal educational opportunity for girls and minorities in advanced mathematics and science. The brochure, titled "What Schools Can Do to Improve Math & Science Achievement by Minority and Female Students," provides background information on girls' and minorities' lower achievement and participation levels in advanced mathematics and science, lays out the specific requirements of Title IX and Title VI related to the issue, and suggests policies and practices that, while not required by law, can promote equal educational opportunity for girls and minorities in advanced mathematics and science.[193] The brochure offers specific suggestions for mathematics and science teachers, department heads, counselors, principals, and school districts as a whole.[194]

---

[184] Ibid.

[185] Ibid.

[186] Ibid.

[187] Ibid.

[188] Ibid.

[189] Ibid.

[190] Ibid., p. 20.

[191] Ibid., p. 21.

[192] Ibid.

[193] OCR, "What Schools Can Do."

[194] Ibid.

CHAPTER 5

Using Neutral and Nondiscriminatory Screening and Diagnostic Procedures

Tests aid the learning process, but they also reflect inequalities in opportunity to learn and participate. Tests provide useful information in considering what alternatives in education and work make most sense for us as individuals. They can also influence our views about groups of students, educational programs, and a wide range of issues. For all of these reasons, it is important that tests assess fairly and reflect accurately the ways young people are and are not achieving as well as we would hope.[1]

Screening and diagnostic procedures are educational practices developed and implemented to determine whether a student is eligible to participate in a particular educational program or course. They are used for identification, evaluation, and assessment for placement, and for classroom performance evaluations and reevaluations. In the context of access to advanced mathematics and science classes, screening and diagnostic procedures range from no specific eligibility requirements other than personal interest and choice, to specific grade requirements, test scores, or teacher recommendations.

Screening and diagnostic procedures can be effective means of ensuring appropriate placement. However, inappropriate or detrimental student evaluation and placement can occur if screening and diagnostic procedures are biased or discriminatory. Educational research has indicated several key problems associated with screening and diagnostic procedures, in particular test bias. Identifying and preventing bias are crucial in helping to eradicate the differences in effect and treatment for girls in advanced mathematics and science education and to ensure that every school works to provide equal opportunity for girls in mathematics and science education.

BARRIERS TO NEUTRAL SCREENING AND DIAGNOSTIC PROCEDURES

Gender Differences in Test Results

Students, parents, and educators rely on both tests and grades as primary sources of information about academic performance, for judging educational progress, and to predict future academic success.[2] Tests of achievement and aptitude are designed to predict student performance in ability groups, college, or professional schools. Items on these tests are based on the assumption that:

> [T]he experiences of different groups have been to some considerable degree common. In order to make the same inferences from test scores, it is assumed that females and males, have had similar opportunities, experiences, activities, and so on. Any differences in performance that occur on aptitude tests are thus a reflection of differences in abilities developed to that point in time. This assumption is clearly untenable for girls in the mechanical area, for example, and sometimes for boys in tests of verbal ability or perceptual speed and accuracy.[3]

The issue of gender bias in testing is particularly relevant to girls in advanced mathematics and science education because scores on standardized tests purporting to measure intelligence or achievement are commonly used to

[1] Warren W. Willingham and Nancy S. Cole, *Gender and Fair Assessment* (Mahwah, NJ: Lawrence Erlbaum and Associates, 1997), p. 1.

[2] Ibid., p. 159.

[3] Esther E. Diamond and Carol Kehr Tittle, "Sex Equity in Testing," in Susan S. Klein, ed., *Handbook for Achieving Sex Equity Though Education* (Baltimore: The Johns Hopkins University Press, 1985), p. 174. *See also* D. Monty Neill, "Transforming Student Assessment," *Phi Delta Kappan*, vol. 78, no. 1 (September 1997), p. 34.

identify students and place them in programs deemed educationally appropriate.[4] At least in part to instruct students "efficiently," schools have sought to provide differentiated educational programs to students with different perceived aptitudes, achievement, and preparation as measured by the students' scores on standardized tests.[5] When used for assigning students to particular courses, standardized tests provide a seemingly consistent way to measure student performance and potential.[6]

In addition to course placement, tests are also relied on extensively for college admissions. The most commonly studied examples of college admissions screening tests are the American College Testing Program (ACT) and the Scholastic Assessment Tests (SAT). Even though there have been positive changes in curricula in recent years, gender differences have remained on college admissions tests of math aptitude.[7] For example, over the past three decades, there has been a 40- to 50-point difference between scores of men and women on the math portion of the SAT, with male test takers consistently scoring higher.[8] On the ACT, math scores average 2.33 points (out of a possible 36 points) higher for males than for females.[9] This is true even though women taking these tests report having higher grades in school than men.[10] Because of the importance of these tests for college admissions decisions, and frequently the awarding of financial aid, these disparities in scores tend to reduce educational opportunities for women.[11]

Similarly, it has been found that test scores on the Graduate Record Exam (GRE), which is used for admission to graduate school, differ by gender, particularly on the subject test in economics. Men score, on average, 48 points higher than women on this test.[12] Even when controlling for grade point average and SAT scores, men score 40 points higher than women on the economics GRE. Thus, researchers have found that women's lower scores cannot be attributed to grades in economic courses, SAT scores, math backgrounds, or solely on the test format itself (multiple choice), leading them to conclude that the "content and structure of the GRE exam may have inherent biases that lead it to underestimate, on average, the potential of women economists."[13]

Eliminating Bias to Achieve Test Fairness

Critics of testing argue that test scores may not reflect accurately the abilities of a particular student, or group of students, because of test bias. Such tests often suffer from gender, cultural, and socioeconomic biases.[14] According to recent research:

---

[4] Asa G. Hilliard III, "Misunderstanding and Testing Intelligence," in John I. Goodlad and Pamela Keating, eds., *Access to Knowledge: An Agenda for Our Nation's Schools* (New York: The College Board, 1990), p. 155; Kenneth A. Sirotnik, "Equal Access to Quality in Public Schooling: Issues in the Assessment of Equity and Excellence," in Goodlad and Keating, eds., *Access to Knowledge*, p. 162.

[5] Paul S. George, "What's the Truth About Tracking and Ability Grouping Really?" in James Bellanca and Elizabeth Swartz, eds., *The Challenge of Detracking: A Collection* (Palatine, IL: IRI/Skyline Publishing, Inc., 1993), p. 255.

[6] Carolyn B. Bagin and Lawrence M. Rudner, "What Parents Should Know About Standardized Testing in Schools?" ERIC Document, 1996, accessed at <http://www.ericps.ed.uiuc.edu/npin/respar/texts/asesmnt/n00030.html>; Jeannie Oakes and Martin Lipton, "Tracking and Ability Grouping: A Structural Barrier to Access and Achievement," in Goodlad and Keating, eds., *Access to Knowledge*, pp. 197–98.

[7] Thomas E. Langenfeld, "Test Fairness: Internal and External Investigations of Gender Bias in Mathematics Testing," *Educational Measurement: Issues and Practice* (spring 1997), pp. 20–26. *See also* chap. 3.

[8] Langenfeld, "Test Fairness," p. 24.

[9] Ibid. *See also* chap. 3.

[10] Willingham and Cole, *Gender and Fair Assessment*, p. 130.

[11] Langenfeld, "Test Fairness," p. 24.

[12] Mary Hirschfeld, Robert L. Moore, and Eleanor Brown, "Exploring the Gender Gap on GRE Subject Test in Economics," *Journal of Economic Education*, winter 1995, pp. 3–15.

[13] Hirschfeld, et al., "Exploring the Gender Gap on GRE Subject Test in Economics," p. 9. *See also* William B. Walstad and Denise Robson, "Differential Item Functioning and Male-Female Differences on Multiple-Choice Tests in Economics," *Journal of Economic Education*, spring 1997, pp. 155–71. These authors suggest that differences in economics test scores for males and females may be partially the result of the fixed or constructed responses format of many tests, since studies have indicated that, in general, women tend to do relatively worse on multiple choice tests and relatively better on essay exams. They also found that males and females scored differently on particular items on a multiple-choice test in economics, suggesting that the test items where significant differences occur may be biased and may mask the true performance of students.

[14] Joan Herman, "Assessing New Assessments: How Do They Measure Up?" *Theory into Practice*, vol. 36, no. 4 (autumn 1997), p. 199.

Tests of mental ability and academic achievement have received a great deal of criticism in recent years. Persistent differences in the performance of different population (racial, ethnic, or gender) groups have sometimes been attributed to the tests' cultural bias. There is little doubt that cultural differences are related to test performance.[15]

According to the U.S. Department of Education, tests "should be used to measure students' abilities, knowledge, or qualifications, regardless of race, national origin, or sex."[16] As such, tests must be valid, reliable, fair, and unbiased.[17] Test bias occurs "when two individuals of equal ability but from different groups respond differently to a test item and therefore do not have the same probability of success on the item,"[18] or when there is a pattern of errors in test scores that systematically affects some groups but not others.[19] It should be noted, however, that because one group scores higher on a test than another group or groups, it does not necessarily mean that the test is biased.[20] Differences in test scores from one group to another can also result from differences in educational opportunity and resources.[21] Differences between male and female performance on standardized tests have also been attributed to factors other than gender bias in standardized tests.

Educational research on gender differences in test scores suggests factors such as exposure to a different set of experiences; different attitudes and expectations on the part of parents, teachers, and other school personnel; encouragement to take certain courses and reject others; and career expectations that follow stereotypical lines all contribute to sex differences in performance on standardized tests.[22] Thus, according to one researcher:

> Assessments of whatever type should not embody stereotypes, contain materials that would be offensive to a particular gender, ethnic, or other subgroup, or pose situations or problems that are likely to be more familiar to some subgroups that to others.[23]

The American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education have developed and widely prescribed testing standards for the development of fair tests. The standards state:

> When selecting the type and content of items for tests and inventories, test developers should consider the content and type in relation to cultural backgrounds and prior experiences of the variety of ethnic, cultural, age, and gender groups represented in the intended population of test takers.[24]

The controversy over gender bias in testing emanates from concerns over the validity of the scores derived from standardized tests and the use of those scores to place and admit students into certain programs.[25] Gender-biased tests provide an inaccurate assessment of males' and females' abilities and impede girls from enrolling in advanced mathematics or science classes in which they would be capable of completing successfully.[26] Assigning students to mathematics and science classes can have a negative effect if a school establishes rigid pupil placement policies for classes based exclusively on general tests of performance or ability.[27] In these situations, students in the lowest tracks can be stigmatized

---

[15] Larry V. Hedges and Amy Nowell, "Changes in the Black-White Gap in Achievement Test Scores," *Sociology of Education*, vol. 72 (April 1999), p. 113 (citations omitted).

[16] U.S. Department of Education, Office for Civil Rights, "Nondiscrimination in High-Stakes Testing: A Resource Guide," draft, April 1999, p. 1.

[17] Ibid., pp. 4–6.

[18] Diamond and Tittle, "Sex Equity in Testing," p. 168.

[19] U.S. Commission on Civil Rights, *The Validity of Testing in Education and Employment*, May 1993, p. 174.

[20] American Association of University Women (AAUW), *How Schools Shortchange Girls* (New York: Marlowe & Co., 1995), p. 53.

[21] Ibid., pp. 52–53.

[22] Diamond and Tittle, "Sex Equity in Testing," p. 169.

[23] Herman, "Assessing New Assessments," p. 199.

[24] Willingham and Cole, *Gender and Fair Assessment*, p. 187 (citing the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education, *Standards for Educational and Psychological Testing*, 1985, p. 26).

[25] Validity refers to the degree to which a test measures what it is supposed to measure, that is, inferences from its scores are appropriate or meaningful as supported by evidence. *See* U.S. Commission on Civil Rights, *The Validity of Testing*, p. 175.

[26] AAUW, *How Schools Shortchange Girls*, p. 57.

[27] Jomills Henry Braddock, II, "Tracking the Middle Grades: National Patterns of Grouping For Instruction," *Phi Delta Kappan*, vol. 71, no. 6 (February 1990), p. 446.

by teachers or peers as poor learners.[28] Because test scores may not be based solely on meritocratic factors, such as achievement or aptitude, but instead can be based in part on students' characteristics such as gender (due to inadequacies with test content or administration), the use of tests as a means to determine students' educational experiences has substantial potential for unfairness.[29]

When evaluating tests for "sex fairness," evaluators need to take three approaches to detecting test bias.[30] First, they should examine the test content for "instances of sex role stereotyping and for the fair representation of women."[31] Second, they should examine "whether females and males performed differently on achievement test items."[32] Third, they should examine the "influences on, or variables related to, sex differences in performance."[33]

Bias can also be eliminated through the use of gender-equitable resources and gender-neutral test questions. For example, gender-equitable resources include materials that depict women in nontraditional careers, with texts and illustrations that depict males and females the same number of times. Another form of gender bias resulting from sex-role stereotyping occurs in testing when questions are based on interests or occupations traditionally associated with males, such as automotive repair or references to sports.[34] For example, many girls may not have exposure to automotive repair or may lack a general knowledge of sports, and therefore test items based on these topics would most likely introduce bias against girls into the test.

Among recommendations of researchers for ensuring test fairness are: (1) review of testing instruments for freedom from sex-role stereotyping and fair representation of females and males in test items, reading passages, and illustrations; (2) review of achievement test results for sex differences in performance; if there are differences, the items can be examined to locate those that have different proportions of girls and boys answering correctly; and (3) at the high school level, a review of score differences between boys and girls in specific content areas to determine if girls are scoring lower and, if so, whether these scores reflect sex bias in the content of test items or the lower scores result from fewer girls taking mathematics and science courses.[35]

The problems arising from test bias have been recognized and addressed to some extent in educational law and policymaking. The federal courts have fashioned remedies on behalf of girls alleging test bias. For example, in the case discussed earlier, *Sharif v. New York State Education Department*,[36] a federal court held that the New York State Education Department's use of the SAT as the sole measure of academic performance discriminated against girls when used for the purposes of awarding scholarships.

The *Sharif* court found that the SAT predicts the success of females differently than it does for males.[37] The court found that "the SAT *underpredicts* academic performance of females in their freshman year of college, and *overpredicts* such academic performance for males."[38] The court noted further:

> [M]ales have outscored females on the verbal portion of the SAT since 1972, with an average score differential of least 10 points since 1981. Males have also consistently outscored females on the mathematics portion with an average differential of at least 40 points since 1967. In 1988, for example, girls scored 56 points lower than boys on the test. The probability that these score differentials happened by chance is approximately about one in a billion and the probability that the result could consistently be so different is essentially zero.[39]

Another case addressed the use of the Preliminary SAT (PSAT) in awarding scholarships.[40] The PSAT helps determine eligibility for National Merit Scholarships. These scholarships totaled $27 million in 1996. They are awarded to

---

[28] Ibid.

[29] Oakes and Lipton, "Tracking and Ability Grouping," p. 193.

[30] Diamond and Tittle, "Sex Equity in Testing," p. 169.

[31] Ibid.

[32] Ibid.

[33] Ibid.

[34] Ibid., pp. 168–69.

[35] Ibid., p. 173.

[36] 709 F. Supp. 345 (S.D.N.Y. 1989). *See* chap. 4.

[37] *Id.* at 353.

[38] *Id.* at 354.

[39] *Id.* at 355.

[40] "College Board Revising PSAT to Settle Bias Claim," *Education Daily*, vol. 29, no. 192 (Oct. 3, 1996), p. 1.

7,000 students annually.[41] Of the pool of students who take the PSAT, 56 percent are girls; however, girls only account for 35–40 percent of the semifinalists chosen by the PSAT scores to compete for the National Merit Scholarships.[42] In 1994, the American Civil Liberties Union filed a complaint on behalf of the National Center for Fair and Open Testing (FairTest) against the College Board and the Educational Testing Service (ETS), which administers the PSAT. Three years later, in March 1997, the Office for Civil Rights (OCR) reached a settlement agreement with the College Board and ETS.[43] The settlement does not specifically state that the PSAT violates Title IX. However, as part of the settlement agreement, ETS agreed to add a writing component to the test in the interest of making the test place more girls, who do better on the verbal section of the test than the mathematics section, in the scholarship pool.[44] In addition, OCR will continue to monitor the changes to the PSAT through 1999 and reserves the right to take further action.[45]

Federal Efforts to Address Biased Diagnostic Procedures

Women's Educational Equity Act

The Women's Educational Equity Act (WEEA) of 1994[46] addresses issues relating to gender equity in schools in the context of neutral and nondiscriminatory screening and diagnostic procedures. The act authorizes the Secretary of Education to provide support and technical assistance to implement effective gender equity policies, including the development of nondiscriminatory tests of aptitude and achievement and of alternative assessments that eliminate biased assessment instruments from use.[47] Federal efforts such as these can be an effective means of achieving neutral and nondiscriminatory screening and diagnostic procedures.

A report of the U.S. General Accounting Office on the pre-1994 statute, which did not contain this provision, evaluated research projects funded under the statute. This report found that WEEA funds were used to promote gender equity "primarily by providing academic instruction, career counseling, and some personal support services that were not available or not sufficiently available in schools and, to a lesser extent, colleges"[48] and not for developing nondiscriminatory screening and diagnostic procedures. When the WEEA was reauthorized in 1994, it included a provision to provide assistance to schools in developing nondiscriminatory screening and diagnostic procedures. However, generally, this provision has not been effective in providing such assistance. This may be due in part to the newness of the provision and because, in 1996, WEEA received no funding from Congress.[49]

Programs and practices developed based on the goals of WEEA, particularly the development of nondiscriminatory aptitude and achievement tests, however, remain potentially promising as ways of helping schools develop practices and programs that use neutral and nondiscriminatory screening and diagnostic procedures in placing students in mathematics and science education. In turn, such programs and practices can help promote gender equity and equal participation for girls in advanced mathematics and science.

---

[41] Ibid.

[42] Ibid.

[43] Ibid., p. 2.

[44] Ibid., p. 1.

[45] Ibid., p. 2.

[46] Pub. L. No. 103-382, tit. V, pt. B, § 5201, 108 Stat. 3695 (codified as amended at 20 U.S. C. §§ 7231-7238 (1994 & Supp. III 1997)). The WEEA was originally enacted in 1974 as Title IV, Part B of the Elementary and Secondary Education Act, Pub. L. No. 89-10, 79 Stat. 27 (codified as amended in scattered sections of 20 U.S.C.) (*see* chap. 2). In 1994, when Congress reauthorized the Elementary and Secondary Education Act as the Improving America's Schools Act, Pub. L. No. 103-382, 108 Stat. 3518 (codified at 20 U.S.C. §§ 6301-8962 (1994)), the WEEA became Title V, Part B of the new act.

[47] 20 U.S.C.A § 7233(b)(2)(A)(x) (1994 & Supp. II 1998).

[48] U.S. General Accounting Office, *Women's Educational Equity Act: A Review of Program Goals and Strategies Needed*, December 1994, p. 15.

[49] Few references to materials on gender bias in testing were found in WEEA resources provided to the Commission. *See* Brenda L. Wolff, special assistant for equity, U.S. Department of Education, letter to Frederick D. Isler, assistant staff director, Office of Civil Rights Evaluation, U.S. Commission on Civil Rights, Sept. 3, 1999 (re: request for information), attachment, "The WEEA Program: 1989–1999"; U.S. Department of Education, Office of Elementary and Secondary Education, *1999 Catalog: WEEA Equity Resource Center at EDC*, 1999.

Title IX Regulations

Title IX requires elementary and secondary public schools to use neutral and nondiscriminatory diagnostic and screening procedures for the placement of girls in educational programs.[50] The protections provided by Title IX prohibit the use of discriminatory appraisal and counseling materials and include language prohibiting the use of sex-biased testing.[51]

OCR'S Enforcement Efforts

Title IX Policy Guidance

High-Stakes Testing Guidance

OCR has issued general draft guidance on the use of achievement, aptitude, and other "high-stakes" testing applicable to Title VI and Title IX.[52] In general, the draft guidelines, released in April 1999, clarify and describe civil rights compliance standards used by OCR and the courts. They contain a thorough discussion of legal principles related to test use and civil rights.

The guidelines are accompanied by a brief background piece in the form of an information pamphlet titled "Test Use and Civil Rights." The pamphlet describes high-stakes tests as those "whose results are used to make placement, promotion, and graduation decisions." The pamphlet provides a broad perspective on discrimination issues arising in the context of high-stakes testing. For example, the pamphlet sets forth OCR's view on why test use is important and illustrates several consequences of testing for individual students. It states:

> The issue of nondiscrimination in testing and assessment is properly viewed as consistent with standards-based reforms—the cornerstone of many of the U.S. Department of Education's initiatives . . . Nondiscrimination in testing and assessment is essential to ensuring that equal opportunities for educational excellence are provided regardless of race, national origin, or sex . . . It is critical that high standards for academic achievement be coupled with the necessary instruction and support that help students reach those standards—as determined by valid and reliable assessments.[53]

Among the specific decisions based on testing that can have important consequences for an individual student, the pamphlet lists:

- Placement in gifted and talented programs.
- Promotion to the next grade or permission to graduate.
- The offering of benefits and opportunities such as admissions or scholarships to specific colleges and universities.

The draft guidance contains two primary sections. The first is a general overview of the document, including discussions on its scope and foundations. The second section, the resource guide itself, contains discussions on basic federal standards, disparate impact and disparate treatment analysis, equal opportunity for limited-English-proficient students, an analysis for cases involving a prior dual system, and applicable remedies.

One of the most important aspects of the document is its discussion of the standards an educational agency must meet to remain in compliance with federal civil rights laws enforced by the U.S. Department of Education.[54] In its discussion on applying legal standards to determine whether discrimination is present, OCR provides thorough guidelines for applicable discrimination analyses, particularly disparate treatment and disparate impact.

The discussion of disparate impact in the guidance addresses one of the more significant forms of discrimination associated with testing practices. In this guidance, OCR clarifies that the appropriate standard for assessing the presence of disparate impact discrimination in the testing context is "educational necessity."[55] As this is the standard that forms the heart of OCR's analysis with respect to disparate impact discrimination, the guidance provides an excellent discussion of educational necessity. The

---

[50] 34 C.F.R. § 106.36 (1998).

[51] *Id.*; *see also* Diamond and Tittle, "Sex Equity in Testing," p. 167.

[52] *See* U.S. Department of Education, Office for Civil Rights, "Nondiscrimination in High-Stakes Testing: A Resource Guide," April 1999; Norma V. Cantú, Assistant Secretary for Civil Rights, U.S. Department of Education, draft memorandum to all OCR staff, Mar. 14, 1995 (re: Fairness in Testing), pp. 5–6, tab A, "Steps for Establishing Disparate Impact."

[53] U.S. Department of Education, Office for Civil Rights, "Test Use and Civil Rights," undated draft, p. 1.

[54] OCR, "Nondiscrimination in High Stakes Testing," pp. 1–10.

[55] Ibid., pp. 3–4.

guidance clearly explains OCR's use of the educational necessity standard as a means of assessing an educational agency's defense of its use of standardized tests. This standard has strong support in case law involving disparate impact discrimination. OCR provides a detailed recitation of this case law, which helps to strengthen the document as a source of guidance to educational agencies and which supports the use of this standard.

In general, the draft guidance is a strong document that sets forth existing law in a clear, through, and detailed fashion that is accessible to the general public, thereby making it valuable to educational recipients of federal funds and their beneficiaries. The strength of the document rests in part on its efforts to show the connection between the somewhat abstract legal standards it discusses and the actual discrimination faced by students in the nation's schools. For example, the guidance makes an implicit connection between the need for the rigorous educational necessity standard and the potential for discrimination based on testing programs by observing that the educational decisions being made based on the tests are decisions of immense consequence. A student's entire academic career can depend on a single examination. Therefore, it is extremely important for the Department of Education to make this connection between applicable legal standards and actual discrimination to show that OCR must apply the most rigorous possible scrutiny to testing programs and practices. As the draft guidelines appropriately note, these are high-stakes tests. Some educational institutions are making the stakes so high in fact, that for OCR to apply a lesser standard would allow rampant discrimination on the basis of disparate impact to occur, discrimination made expressly illegal under the Title VI regulations OCR enforces.

Fairness in Testing Guidance

In 1995, OCR developed a draft guidance titled "Fairness in Testing." Though the guidance has not been formally issued because it is pending consultation with the National Academy of Sciences on discrete issues, it is currently used by OCR investigators.[56] The purpose of the guidance is to articulate clearly "the testing and assessment parameters that guide OCR investigations" in the area of fairness in testing.[57] The guidance applies to tests that are used as a basis for admissions, scholarship awards, placement evaluations, vocational education counseling, and diploma awards.

The guidance emphasizes that OCR investigators may look at both disparate treatment and disparate impact when determining whether a test is discriminatory. Further, it makes the point that there may be several responses to correcting a violation, depending on the facts of a case, including supplementing the use of a test with other assessment measures, revising the test instrument, substituting the test with another more valid instrument, and enhancing students' abilities to perform well on the test.[58] OCR's draft investigative guidance on the underrepresentation of women and girls in mathematics and science also addresses the issue of neutral and nondiscriminatory screening and diagnostic procedures in ensuring nondiscrimination and gender equity in opportunity to pursue advanced mathematics and science.[59]

Investigations and Monitoring

There has been little Title IX litigation directly relating to discrimination on the basis of sex in screening and diagnostic procedures for mathematics and science education. Such litigation, under the Equal Protection Clause, Title IX, or both, could inform a useful equal protection or Title IX discrimination analysis for OCR to advance in updated policy and investigative guidance, which, unlike OCR's 1999 draft guidelines, would be geared specifically toward Title IX in the context of advanced mathematics, science, and technology education. Despite the lack of existing litigation to draw on, OCR has developed an approach for investigating screening and diagnostic practices.

Investigative Methods

In assessing student placement in advanced mathematics and science courses, OCR reviews a school's placement criteria. Typically, teacher recommendations provide the main criterion for

---

[56] Norma V. Cantú, Assistant Secretary for Civil Rights, U.S. Department of Education, draft memorandum to OCR Staff (re: Fairness in Testing), Mar. 14, 1995.

[57] Ibid., p. 2.

[58] Ibid.

[59] *See* discussion, pp. 77–78.

placement decisions. OCR does not encounter many schools that use multiple criteria or strict guidelines for placement decisions. OCR's methodology for addressing this problem has evolved over time. In the past, OCR simply asked schools to address the problem; however, more recently, OCR has provided greater specificity by outlining multiple criteria with specific guidelines.[60] OCR's position is to require multiple identification and evaluation mechanisms for placement decisions. Although OCR permits schools to use validated IQ tests for their intended purpose, in cases where OCR finds a violation, it requires schools to provide other forms of screening, including portfolio reviews, grade reviews, or teacher recommendations for students who do not test well.[61]

Under the educational necessity standard, OCR will undertake the following searching analysis to make its assessment as to whether discrimination has resulted from a given testing practice:

- Whether the educational institution's use of a test results in a significantly disproportionate denial of an educational benefit or opportunity to members of a particular race, national origin, or sex.
- If so, whether the test is educationally necessary.
- If so, whether there are practicable alternative forms of assessment that would substantially serve the school's stated purpose and are valid and reliable for the purpose but have a less discriminatory impact on the basis of race, national origin, or sex.

The educational necessity standard is rigorous in that it requires an educational agency to show that the test it is using is valid and reliable for the purpose for which it is being used. The scrutiny OCR will apply in evaluating whether there is validity and reliability is appropriately searching.

OCR's draft investigative manual directs OCR staff, when disparities are found in male and female students' enrollment patterns, to examine the placement criteria used by the school district, including "the use of testing instruments for guidance or ability grouping."[62] Staff are directed to "determine whether they comprise objective, educationally relevant measures which have been validated for ability grouping or tracking in mathematics and science"[63] and whether the tests "have been validated for the population being tested,"[64] to determine whether the tests exhibit gender bias, and to ascertain whether the tests are being used consistently and appropriately.[65]

Cases on Screening and Diagnostic Procedures

As is the case elsewhere with respect to Title IX enforcement for academic issues, OCR has conducted few compliance reviews and has received few complaints specifically addressing Title IX compliance in the context of screening and diagnostic procedures. However, the following two examples illustrate the general approach OCR has taken in the few investigations it has conducted addressing this issue.

As discussed earlier, one recent OCR investigation that has received a great deal of media attention involved allegations of gender discrimination against the College Board and the Educational Testing Service with regard to the PSAT. The investigation stemmed from allegations that the PSAT is biased against girls. Although OCR made no finding of a Title IX violation in the case, the College Board and ETS have agreed to revise the PSAT as part of a settlement agreement. The complaint, filed in 1994, suggested that in light of historic disparities on standardized tests, the sole use of PSAT scores to determine recipients of the scholarship discriminated against girls.

OCR's New York Enforcement Office addressed a complaint of gender discrimination also based on sex bias in selection criteria. The complainant alleged that the Lenape Regional

---

[60] Steve Deering, David Rolandelli, Louise Bonanova, Office for Civil Rights, Region IX, U.S. Department of Education, telephone interview, June 25, 1996.

[61] Sherry Goldbecker, issue coordinator for minorities and women in mathematics and science, Office for Civil Rights, U.S. Department of Education, interview in Washington, DC, May 30, 1996.

[62] U.S. Department of Education, Office for Civil Rights, "Investigative Manual: Underrepresentation of Females and Minorities in Upper-Level Mathematics and Science in Secondary Schools," draft, August 1994, p. I-2.

[63] Ibid., p. I-6.

[64] Ibid.

[65] Ibid.

High School District discriminated on the basis of sex. The letter of finding stated, "Specifically, the complainant allege[d] that the District denied a [female] the opportunity to be considered as a candidate for the National Science Scholars Program (NSSP)."[66] The complainant alleged that the district discriminated on the basis of sex by denying the student the opportunity to be considered as a candidate for the NSSP. The complainant stated that the district did not use objective criteria and chose two students, a male and a female, who had "lesser qualifications in math and science than the student," as its nominees for the NSSP.[67]

During this investigation, OCR reviewed and analyzed documents submitted by the district and the complainant and interviewed district personnel and the complainant. Based on an analysis of the information obtained, OCR determined that the district complied with the Title IX regulation and therefore closed the case. The letter of finding provides a thorough and complete analysis of the reasoning used by the school in choosing the male candidate. In addition, the letter of finding clearly states that the criteria used to make this determination were wholly appropriate, nondiscriminatory, and based on sound educational theory.[68]

Technical Assistance, Outreach, and Education

OCR has produced a number of technical assistance documents addressing issues relating to Title IX and girls in advanced mathematics and science education. OCR has assisted state departments of education and local school districts by developing, in cooperation with other Department of Education offices, materials that specifically address the ways in which policies and practices such as screening and diagnostic procedures, including testing in the classroom and standardized tests, can entrench discriminatory practices and outcomes.[69] For example, on the testing issue in this context, OCR has offered guidance to schools through technical assistance documents on Title IX and Title VI compliance. The Title IX document generally approaches screening and diagnostic procedures from a counseling perspective.[70] However, OCR's Title VI technical assistance document provides more specificity to schools by indicating that "schools must ensure that all screening procedures are nondiscriminatory."[71] The document also indicates that under certain circumstances "periodic testing and reevaluation of students in specialized courses may be required."[72]

A technical assistance document for use by OCR staff titled "Equal Opportunities for Girls and Women to Participate in Math and Science" states with respect to testing instruments: "Research shows that one result of bias in standardized testing is that test scores may provide an inaccurate picture of girls' and boys' abilities. With respect to gender fairness, the selection of test items with different characteristics is critical."[73] In providing information to OCR staff on this issue as it relates to nondiscrimination on the basis of sex, this technical assistance document states further:

> Test items can differ in terms of 1) the item content and context (e.g., references to females, males, or subject matter that may be more of interest to students of one gender than students of the other gender); 2) the format of the test (e.g., girls tend to score higher on essay or open-minded items while boys tend to score higher on multiple-choice items); and 3) skill areas being tested (e.g., if a math test emphasizes computation, logic, and combined arithmetic-and-algebra skills, girls will do better but if the test emphasizes word problems and combined arithmetic-and-geometry skills, boys will do better).[74]

This information appears useful for OCR staff. However, this document would be more persuasive if it contained references for the propositions it is stating as facts. This document notes finally that:

---

[66] Paula Kuebler, U.S. Department of Education, Office for Civil Rights, letter to K. Kiki Konstantinos, superintendent, Lenape Regional High School District, Medford, NJ, Dec. 6, 1991 (OCR docket no. 02-91-1097).

[67] Ibid.

[68] Ibid.

[69] *See* chap. 3.

[70] U.S. Department of Education, Office for Civil Rights, "Student Assignment In Elementary and Secondary Schools and Title IX," technical assistance document, undated.

[71] Ibid.

[72] Ibid.

[73] U.S. Department of Education, Office for Civil Rights, "Equal Opportunities for Girls and Women to Participate in Math and Science," technical assistance document, March 1993, p. 9.

[74] Ibid.

Current research indicates that when there is exclusive reliance on standardized assessment measures with respect to student placement, girls who are gifted in mathematics are less likely to be identified than are gifted boys and are less likely to participate in special or accelerated mathematics courses. The research suggests that other factors, such as grades, portfolios of student work, extracurricular achievements, and out of school accomplishments, should be considered along with test scores when making judgments about girls' and boys' skills and abilities.[75]

Here again, this seems useful information for OCR staff, particularly since it addresses subject matter that can have an important effect on girls' ability to participate equally with boys in upper-level mathematics and science education. However, it should be noted again that this would be a stronger document if the source of this information were cited. In addition, the document appears to have been developed in early 1993. OCR should provide more recent technical assistance guidance to staff addressing sex discrimination.

It is apparent from the research that testing has potential to determine the opportunities afforded to students. Unfair testing has the potential to limit those opportunities and the future educational success of students. Therefore educators and civil rights advocates must work together to ensure fairness in test development and administration as well as in other forms of screening and diagnostic procedures.

[75] Ibid.

CHAPTER 6

Facilitating Girls' Achievement in Math, Science, and Technology: Parents, Teachers, Counselors, and School Resources

PARENTAL NOTIFICATION AND INVOLVEMENT

Educational Research

Educational researchers have long recognized the importance of parents' involvement in their children's education.[1] Research has shown that parents influence their children's perceptions, attitudes, and decisions about careers.[2] Parents also influence where their children go to school and the type of education they receive.[3] Parental involvement also is positively related to students' achievement.[4] The Department of Education has noted that when both parents are involved in their children's education, their children are more likely to get "A's" and less likely to repeat a grade, be suspended, or be expelled.[5] According to the Department:

> It has become increasingly evident that parental involvement in education contributes to students' achievement in school. When families are involved in children's learning, at school and at home, everyone

[1] *See* National Education Association, "Parent Power: A Major Ingredient in the Recipe for Educational Success," no date, accessed at <http://www.nea.org/parents/ppower.html>; Jerry Trusty, "Relationship of Parental Involvement in Teens' Career Development to Teens' Attitudes, Perceptions, and Behavior," *Journal of Research and Development in Education*, vol. 30, no. 1 (fall 1996), pp. 63–69; Dorothy Rich, "Bridging the Parent Gap in Education Reform," *Educational Horizons*, winter 1988, pp. 90–92; James P. Comer, "Parent Participation in the Schools," *Phi Delta Kappan*, February 1986, pp. 42–46; James S. Coleman, "Families and Schools," *Educational Researcher*, August/September 1987, pp. 32–38; Oliver C. Moles, "Who Wants Parent Involvement? Interest, Skills, and Opportunities Among Parents and Educators," *Education and Urban Society*, February 1987, pp. 137–45; Joyce L. Epstein, "Parent Involvement: What Research Says to Administrators," *Education and Urban Society*, February 1987, pp. 119–36.

[2] *See* Leon Feinstein and James Symons, "Attainment in Secondary School," *Oxford Economic Papers*, vol. 51, no. 2 (Apr. 1, 1999), p. 300; National Parent Teacher Association, "National Standards for Parent/Family Involvement Programs," 1998, accessed at <http://www.pta.org/programs/pfistand.htm>; National Science Teachers Association, "An NSTA Position Statement: Parental Involvement in Science Education," 1994, accessed at <http://www.nsta.org/handbook/parent.htm> (hereafter cited as NSTA, "Parental Involvement"); Sandra L. Hofferth, Johanne Boisjoly, and Greg J. Duncan, "Parents' Extrafamilial Resources and Children's School Attainment," *Sociology of Education*, vol. 71 (July 1998), pp. 246–68; Susan A. Ambrose, *Journey of Women in Science and Engineering: No Universal Constants* (Philadelphia: Temple University Press, 1997), p. 24; Betty M. Vetter, executive director, Commission on Professionals in Science and Technology, *Status of Women Scientists & Engineers in the United States* (Washington, DC: American Association for the Advancement of Science, 1994), attachment to Shirley B. Malcom, head, Directorate for Education and Human Resources Programs, American Association for the Advancement of Science, Testimony Before the Subcommittee on Energy, Committee on Science, Space, and Technology, U.S. House of Representatives, 103rd Cong., 2d sess., Hearing on "Women and K–12 Science and Mathematics Education," June 28, 1994 (hereafter cited as 1994 Hearing), p. 76 (hereafter cited as Malcom testimony); Jane T. Stutsman, deputy assistant director, Division of Education and Human Resources, National Science Foundation, Testimony Before 1995 Hearing, p. 118 (hereafter cited as Stutsman testimony).

[3] Miriam David, "Involvements and Investments in Education," *Journal for a Just and Caring Education*, vol. 4, no. 1 (January 1998), pp. 30–46.

[4] Dominic D. Peressini, "What's All the Fuss About Involving Parents in Mathematics Education?" *Teaching Children Mathematics*, February 1998, p. 321.

[5] U.S. Department of Education, "America Goes Back to School: Welcome," no date, accessed at <http://www.ed.gov/Family/agbts/welcome.html>.

benefits—schools work better, families become closer, and students improve academically.[6]

In particular, parents have enormous influence over the participation of their daughters in mathematics and science.[7] Girls who are not encouraged at home to pursue curricula or careers in mathematics and science tend not to pursue these types of courses or professions.[8] Nonetheless, many girls are not encouraged at home, and parents tend to provide more encouragement in mathematics and science to their sons.[9]

Further, studies have shown that some parents feel that they lack sufficient knowledge of mathematics and science to provide encouragement.[10] Researchers have reported that parents who express negative attitudes toward mathematics communicate these same attitudes to their children.[11] Many parents tend to encourage their daughters to take such courses as reading, writing, and home economics, or focus on social skills, because many parents, particularly mothers of female students, were not exposed to mathematics and science courses beyond the standard requirements for graduation.[12]

Educational researchers report that without collaboration between educators and parents, gender-biased curricula will remain.[13] The benefits of involvement for parents include an understanding of how teaching mathematics has changed, increased understanding of the importance of mathematics education, and improved confidence in their ability to help their children.[14] Children also benefit:

> When parents and teachers form home-school partnerships, children are more likely to see a unified front between parents and teachers. Rather than struggle with two seemingly different opinions and methods of doing mathematics, children are able to share the same enjoyable and meaningful mathematics experiences with their parents at home that they do with their teacher in school. . . . While doing mathematics with their parents, children may see that Mom and Dad do not always know the answers immediately and that sometimes adults make mistakes. Mistakes afford an excellent opportunity for parents to help a child see the value in examining a wrong answer. Knowing why something is wrong can lead to understanding.[15]

Research suggests that the participation of girls in mathematics and science will increase if parents are exposed to these courses through outreach and other parent-incentive programs. Studies report that, to encourage their daughters to pursue mathematics and science, many parents need to understand the importance and relevance of education in mathematics and science, and the need to work with the school in the curriculum and career decisionmaking processes.[16] As one educational researcher explains:

---

[6] U.S. Department of Education, Partnership for Family Involvement in Education, "Family-School: Welcome," 1998, accessed at <http://www.pfie.ed.gov/family_welcom.php3>

[7] *See* NSTA, "Parental Involvement"; U.S. Department of Education, Office for Civil Rights, Policy, Enforcement, and Program Service, *Promising Practices: Access for Women and Minorities to Mathematics and Science Programs and Gifted and Talented Education Programs*, April 1996, p. 4; Julia Wrigley, ed., *Education and Gender Equality* (Bristol, PA: The Falmer Press, 1992), pp. 221–22. *See also* 1994 Hearing, appendix, "Additional Questions for the Record," pp. 165, 169–70, 190 (answers provided by Susan McGee Bailey, Jane Butler Kahle, and Jane Stutsman); Tracy Thorndike-Christ, "Attitudes Toward Mathematics: Relationships to Mathematics Achievement, Gender, Mathematics Course-taking Plans, and Career Interests," ERIC Document ED 347 056 (April 1991), pp. 14–15.

[8] *See* Wrigley, *Education and Gender Equality*, pp. 220–21. *See also* Marilyn Lloyd, Chairperson, Subcommittee on Energy, Committee on Science, Space, and Technology, U.S. House of Representatives, Opening Statement, 1994 Hearing, pp. 1–2 (hereafter cited as Lloyd statement); Stutsman testimony, pp. 121–23; Rebecca Failor, member of board of directors and former president, Math/Science Network, Testimony Before 1994 Hearing, p. 148 (hereafter cited as Failor testimony); Malcom testimony, p. 67.

[9] *See* 1994 Hearing, appendix, "Additional Questions for the Record," p. 165 (answers provided by Susan McGee Bailey). *See also* Thorndike-Christ, "Attitudes Toward Mathematics," p. 15; Jennifer Gutbezahl, "How Negative Expectancies and Attitudes Undermine Females' Math Confidence and Performance: A Review of the Literature," ERIC Document ED 380 279 (Mar. 26, 1997), p. 2.

[10] Wrigley, *Education and Gender Equality*, pp. 208–09, 211, 215, 219–20, 221–23.

[11] Thorndike-Christ, "Attitudes Toward Mathematics," p. 15.

[12] Wrigley, *Education and Gender Equality*, pp. 221–23.

[13] *See* Alison Danielle Lucidi, "Gender Equity in Education: A Review of the Literature," ERIC Document ED 374 044, (Apr. 28, 1994), p. 40.

[14] Marilyn Sue Ford, Robin Follmer, and Kathleen K. Litz, "School-Family Partnerships: Parents, Children, and Teachers Benefit!" *Teaching Children Mathematics*, February 1998, pp. 310–11.

[15] Ibid., p. 311.

[16] *See* Wrigley, *Education and Gender Equality*, pp. 217–19.

Because we are aware that young women are often more strongly influenced than young men by the opinions of family, teachers, and friends, these groups must be included in any effort to increase the participation of females in science, engineering, and mathematics careers and activities.[17]

As another researcher explains, if parents are not aware of how to provide a gender-free educational environment, schools' efforts to achieve this goal may be "sabotaged."[18] Today, with the focus on technology, parents need to be trained and provided information to make them aware of the importance and relevance of mathematics and science in education, particularly for girls.[19] Further, while information for parents is important, the Department of Education notes that "[p]arents do not have to be highly educated or have a lot of free time in order to help their children learn."[20]

Programs and Initiatives

At least four major federal statutes fund gender equity programs and projects: the Women's Educational Equity Act (WEEA) of 1994;[21] the Dwight D. Eisenhower Professional Development Federal Activities Program;[22] the Excellence in Mathematics, Science and Engineering Education Act;[23] and Goals 2000: Educate America Act.[24] Under these statutes, the Federal Government has provided school districts with funds for technology, training programs for teachers in mathematics and science, workshops and other forums, as well as other gender equity incentives to facilitate and enhance female participation in mathematics and science.[25] In addition, these statutes provide for involvement of parents in educational programs.

The Women's Educational Equity Act of 1994 includes provisions relating to parental notification and involvement in its gender equity programs for mathematics and science. The act states in its findings, "Federal assistance for gender equity must be tied to systemic reform, involve collaborative efforts to implement effective gender practices at the local level, and encourage parental participation. . . ."[26] In addition applicants for funding are required to "demonstrate how parental involvement in the project will be encouraged."[27]

---

[17] 1994 Hearing, appendix, "Additional Questions for the Record," p. 190 (answers provided by Jane T. Stutsman).

[18] Lucidi, "Gender Equity in Education," pp. 5–6.

[19] *See, e.g.*, Lloyd statement, pp. 1–2; Stutsman testimony, pp. 121–23; Failor testimony, p. 148.

[20] DOEd, Partnership for Family Involvement in Education, "Family-School: Welcome."

[21] Pub. L. No. 93-380, tit. IV, pt. B, § 408, 88 Stat. 554 (codified as amended at 20 U.S.C. §§ 7231–7238 (1994 & Supp. III 1997)). The act provides financial assistance to promote, coordinate, and evaluate gender equity policies, programs and initiatives in federal educational programs. 20 U.S.C. § 7233 (1994).

[22] 20 U.S.C. § 6601 (1994). This program was authorized under the Elementary and Secondary Education Act of 1965, Title II, as amended. Pub. L. No. 89-10, § 2000I, as added Pub. L. No. 103-382, § 101, 108 Stat. 3612. The forerunner to the Federal Professional Development Activities Program was the Dwight D. Eisenhower Mathematics and Science Education Program established in 1988. Pub. L. No. 89-10, Title II, as added Pub. L. No. 100-297, § 1001, 102 Stat. 219–227, Part A, Section 2012.

[23] The Excellence in Mathematics, Science and Engineering Education Act of 1990 (The Excellence in Education Act), Pub. L. 101-589, tit. VI, pt. A (codified at 20 U.S.C. § 5301 (1994)).

[24] Pub. L. No. 103-227, 108 Stat. 125 (codified at 20 U.S.C. §§ 5801–6084). Goals 2000 is intended to increase opportunities for women in mathematics, science, and engineering. In addition, states can use funding provided under Goals 2000 to provide special attention to the needs of female students. Other federal programs support gender equity, such as the Perkins Vocational Education Act and programs deriving from Title IV of the Civil Rights Act of 1964.

[25] The Women's Educational Equity Act provides financial assistance to enable educational agencies and institutions to meet the requirements of Title IX. Priorities for funding include projects to develop educational training, counseling, or other programs to increase the interest and participation of women in mathematics, science, and computer science courses, or to enhance their skills in those areas. The act authorizes the Department of Education to fund grant awards for gender equity programs in schools, and provide grants for research and development. 20 U.S.C. § 7231 (1994 & Supp. II 1996); 34 C.F.R. §§ 246.11(b), 247.11(c) (1998).

The Dwight D. Eisenhower Professional Development Federal Activities Program focuses on research grants to improve the quality of instruction in elementary and secondary school mathematics and science, disseminate information on gender equity research issues, and prepare teachers and other school personnel to teach academic subjects under the act to children with disabilities. 20 U.S.C. § 6622 (1994).

See also U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, December 1996, pp. 46–47; American Association of University Women, *Creating a Gender-Fair Federal Education Policy*, January 1993, p. 2.

[26] 20 U.S.C. § 7231(b)(6) (1994).

[27] *See* 20 U.S.C. § 7234(6) (1994).

In another statute promoting gender equity in mathematics and science, the Dwight D. Eisenhower Professional Development Federal Activities Program, Congress recognized the importance of parental involvement by including a provision requiring recipients to develop strategies that can involve parents in the program or project.[28] One of the findings in the act states:

> Parental involvement is an important aspect of school reform and improvement. There is a need for special attention to ensure the effective involvement of parents in the education of their children. Professional development should include methods and strategies to better prepare teachers and, where appropriate, administrators, to enable parents to participate fully and effectively in their children's education.[29]

Some states and school districts have taken the lead in including parental involvement as a component in their programs to improve the participation of girls and minority students in mathematics, science, and technology.[30] For example, in Florida, where parental involvement has increased, researchers recommend that the state continue to enlist the assistance of parents as resources in math and science activities.[31] In Milwaukee, Wisconsin, to address the mathematics test scores of students, schools offered tutoring sessions and enlisted the assistance of churches and businesses to provide resources. As a result, attendance at Parent and Teachers Association (PTA) meetings increased.[32] In Minnesota, North Dakota, and South Dakota, Girl Scout leaders and assistants—most of whom were parents—were trained in math and science concepts for the program, "Girls and Science: Linkages for the Future."[33] However, because there are no standards or criteria for parental involvement in mathematics and science, the quantity and quality of information to parents and parental participation in activities related to those subjects vary among school districts.

Congress and DOEd have incorporated parental involvement extensively in federal statutes and regulations outside the gender equity context as well. For example, in federal education statutes relating to disabilities and limited English proficiency, Congress and DOEd have made parental involvement a critical element in the successful education of students.

More specifically, Congress and DOEd, through legislation and implementing regulations, have required parental notification and encouraged parental involvement in the education of children with disabilities and children with limited English proficiency. Through the Individuals with Disabilities Education Act (IDEA), Congress and DOEd created requirements and programs to facilitate parental knowledge, notification, and involvement in the education of children with disabilities. IDEA's Part B provisions and implementing regulations require that school districts provide written notice to parents before they propose or refuse to initiate or change the identification, evaluation,

---

[28] 20 U.S.C. § 6602(9) (1994). Although it focuses on teacher training programs, the National Teacher Training Project Act of 1994, which is included in the Dwight D. Eisenhower Professional Development Program legislation, requires contractors receiving grants to include parental involvement strategies as a component in the projects:

"to establish, operate, and provide the non-Federal share of the cost of teacher training programs in effective approaches and processes for the teaching of the core academic subjects for which such eligible recipient was awarded a grant, including approaches and processes to obtain parental involvement in a child's education; . . ."

"However, the 'core subject areas' mentioned in the program are not limited to mathematics and science. Under the National Teacher Training Act, projects can include other subjects, including English, Foreign Languages, Arts, History and Economics. While mathematics and science may be considered, the exclusive emphasis of approaches do not have to include mathematics and science." 20 U.S.C. § 6623 (1994).

[29] 20 U.S.C. § 6602(9) (1994).

[30] An evaluation of Florida's Comprehensive Plan to improve mathematics, science, and computer education found that one of the initiatives is expanding the collaboration of educators, parents, and businesses in the efforts. As a result of this initiative, approximately 70 percent of the teachers surveyed acknowledged some degree of parental involvement in the activities, and that parental participation had increased in the elementary and middle schools. Thomas M. Dana and Kenneth L. Shaw, "An Evaluation of the Implementation of Florida's Comprehensive Plan to Improve Mathematics, Science and Computer Education," paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA, ERIC Document ED 353 142 (April 1992), pp. 1, 22.

[31] Ibid., p. 23.

[32] Renee Sanchez, "The Hard Truths of Higher Standards: Schools Raise Hurdles, Struggle to Meet Them: Many States are Revising Curriculum," *The Washington Post*, Jan. 23, 1997, p. A9.

[33] Malcom testimony, pp. 68, 156–57.

or educational placement of a student.[34] They also require school districts to obtain parental consent[35] and specify that parents be included in meetings to develop, review, and revise their child's individual education program.[36] The provisions and regulations place responsibilities on state educational agencies and school districts to provide due process procedures for students with disabilities and their parents.[37] Provisions also ensure that parents of students with disabilities have an opportunity to participate in the policymaking process through an advisory panel.[38]

Similarly, DOEd's regulations implementing Section 504 of the Rehabilitation Act require federally funded school districts to notify parents of students with disabilities of their responsibility to provide a free appropriate public education.[39] The districts must provide parents and guardians with notice before taking action to identify students as having disabilities, evaluate students, or begin or change placement of students with disabilities.[40] The regulations also prescribe that opportunities are made available so that parents can be involved in their children's education and the policymaking process. Beyond the provisions and regulations on parental notification and involvement, there are federal financial assistance programs that support parental involvement in education.[41]

The Bilingual Education Act places a similar responsibility on state and local educational agencies accepting funds under the act's programs to involve parents in the education of students with limited English proficiency. As with the WEEA and the Eisenhower program, the act recognizes the importance of parental involvement in its "Findings, Policy, and Purpose" section and in provisions for local school district applicants for federal funding.[42] The act requires schools or school districts receiving funds to notify parents before placing their children in programs designed to develop English proficiency.[43] More importantly, the act recognizes that there are a number of challenges facing these students in receiving an education that allows them to participate fully in American society. One of these challenges is the limited English proficiency of their parents, which hinders the parents' ability to participate in the education of their children.[44]

Educational research has long supported parental involvement in the mathematics and science education of girls. In addition, parental notification and inclusion are critical elements in the legislation and regulations ensuring equal educational opportunities and nondiscrimination for children with disabilities, children with limited English proficiency, and girls. For example, the Title IX regulation requires notification to parents regarding protections afforded by Title IX. Because of Title IX, where parental involvement is necessary to remedy a civil rights violation, it can be required.[45] In addition, federal statutes that provide for programs and projects for girls to promote gender equity, such as the WEEA, include provisions on parental notification and inclusion.

Congress and DOEd recognize the importance of parents' role in mathematics and science education. As a result of their recent actions, parental inclusion in mathematics and science has become an important federal issue in gender

---

[34] 20 U.S.C. § 1415(b)(1)(C) (1994 & Supp. III 1997); 34 C.F.R. § 300.504(a) (1998).

[35] 20 U.S.C. § 1415(b)(1)(C) (1994 & Supp. III 1997); 34 C.F.R. § 300.504(b) (1998).

[36] 20 U.S.C. § 1401(a)(20) (1994 & Supp. III 1997); 34 C.F.R. §§ 300.344(a), 300.345(a) (1998).

[37] 20 U.S.C. § 1415 (1994 & Supp. III 1997); 34 C.F.R. §§ 30.501–10 (1998).

[38] 20 U.S.C. § 1413(a)(12) (1994 & Supp. III 1997).

[39] 34 C.F.R. § 104.32(b) (1998).

[40] *See* 34 C.F.R. § 104.36 § pt. 104, app. A, subpt. D, no. 25 (1998).

[41] *See* 20 U.S.C. § 1421(a) (1994 & Supp. III 1997); 20 U.S.C. § 1431(c)(1) (1994 & Supp. III 1997); 20 U.S.C. § 1431(c)(1) (1994 & Supp. III 1997).

[42] *See* 20 U.S.C. § 7402(a)(5)(C) (1994); 20 U.S.C. § 7422 (b)(2)(B)(i) (1994).

[43] 20 U.S.C. § 7602(b)91)(A)–(C) (1994).

[44] *See* 20 U.S.C. § 7402(a)(5)(C) (1994).

[45] In 1993, the American Association of University Women recommended that there should be additional criteria for funding programs under the Women's Educational Equity Act. The organization recommended that one of the additional criteria to help eliminate inequitable gender equity practices should be parental involvement. *See* American Association of University Women, *Creating a Gender-Fair Federal Education Policy*, January 1993, p. 4. *See also* U.S. Department of Education, Office for Civil Rights, "What Schools Can Do to Improve Math & Science Achievement by Minority and Female Students," undated brochure, pp. 21–24 (hereafter cited as OCR, "What Schools Can Do"). *See also* Dwight D. Eisenhower Professional Development Federal Activities Program, 20 U.S.C. § 6601(9) (1994); 20 U.S.C. § 6623 (1994).

equity. The presence of provisions on parental involvement in federal education-related statutes can greatly assist schools in their efforts to include and involve parents in mathematics and science education of their children, and to ensure that the quality and quantity of parental inclusion will continue to grow. Importantly, without federal encouragement of parental inclusion, it is likely girls will remain underrepresented in higher-level mathematics, science, and technology curricula and technological careers.

OCR's Enforcement Efforts

Title IX Regulations and Policy

Only one section of Title IX[46] relates to parental involvement. Section 1681(8) of the act requires that if there are father-son or mother-daughter activities for students in an educational institution, there must also be comparable activities provided for the other sex.[47] In addition, the Title IX regulation requires recipients to take

> specific and continuing steps to notify . . . parents of elementary and secondary school students . . . that it does not discriminate on the basis of sex in the educational programs or activities which it operates, and that it is required by Title IX and this part not to discriminate in such a manner.[48]

DOEd's Title IX regulations do not, however, contain a provision on parental notification and involvement in academics, generally, or mathematics and science, in particular.[49]

As discussed earlier, OCR has drafted policy documents relating to Title IX, including the investigative manual on underrepresentation in mathematics and science as well as guidance on sexual harassment and intercollegiate athletics. OCR has not issued policy guidance related to parental notification and involvement as it applies to access of females to advanced mathematics and science courses. Without such guidance, schools have no formal notice of the importance, for civil rights compliance purposes, of ensuring that parents are fully notified and involved in decisions relating to their children's participation in mathematics and science.

Technical Assistance, Outreach, and Education

OCR includes parental notification in its outreach for school districts to improve mathematics and science participation and achievement of female students.[50] In 1992, DOEd funded a brochure on parental involvement in mathematics and science.[51] The brochure offers six suggestions to assist parents in encouraging their daughters to take math and science classes. These suggestions include:

- Emphasizing the importance of mathematics and science in career choices.
- Influencing their daughters' attitudes toward these subjects.
- Participating in activities at home to foster a more positive view of mathematics and science.
- Helping to reduce stereotypes related to women's roles in mathematics and science.
- Evaluating information on women's abilities in mathematics and science.
- Taking action when their daughters are treated with bias toward their abilities in mathematics and science.[52]

There were 10,000 requests for the brochure within 6 months of its publication, indicating that it has been widely read and disseminated.[53]

---

[46] Title IX of the Education Amendments Act of 1972, Pub. L. No. 92-318, tit. IX, 86 Stat. 373 (codified as amended at 20 U.S.C. §§ 1681–1688 (1994)).

[47] 20 U.S.C. § 1681(8) (1994).

[48] 34 C.F.R. § 106.9(a)(1) (1998).

[49] 34 C.F.R. §§ 106.1–106.7 (1998).

[50] OCR collects statistics on student enrollment in mathematics and science classes, and in gifted and talented programs (GATE) which may include mathematics and science. Steve Deering, team leader, Office for Civil Rights, Region IX, U.S. Department of Education, telephone interview, June 25, 1996, p. 1. Resolutions for GATE programs often require outreach to minority parents. Louise Bonanova, equal opportunity specialist, Office for Civil Rights, Region IX, U.S. Department of Education, telephone interview, June 25, 1996, p. 3. In this region, outreach to minority parents is a part of the resolutions in advanced mathematics and science courses as well. However, OCR has found that although notice is given to all parents, cultural factors make some parents more likely than others to participate. One solution may be to contact parents in their native language. David Rolandelli, equal opportunity specialist, Office for Civil Rights, Region IX, U.S. Department of Education, telephone interview, June 25, 1996, pp. 3–4.

[51] Patricia B. Campbell, "Math, Science, and Your Daughter: What Can Parents Do? Encouraging Girls in Math and Science Series," ERIC Document ED 350 172 (1992), pp. 2–9.

[52] Campbell, "Math, Science and Your Daughter," Abstract, p. 1.

OCR also prepared a pamphlet for elementary and secondary school administrators, counselors, and teachers on how to improve mathematics and science achievement for girls.[54] It includes the following suggestions for involving parents in mathematics and science programs:

- Recommending intervention strategies with the involvement of parents, teachers, and other groups to discuss student achievement discrepancies and progress of minority and female students in mathematics and science.
- Engaging parents interested in promoting mathematics and science by providing career guidance materials.
- Sharing labor market outlook data on minorities and females in the work force.
- Planning a parents' night on science and mathematics careers.
- Communicating through telephone calls and notes to parents of students who are underachieving in mathematics or science.
- Helping parents understand their role in encouraging their children's interest in mathematics and science.
- Recommending subscriptions to science and mathematics magazines.
- Issuing a listing of science and mathematics activities for parents and children at museums, business fairs, and high technology companies.
- Establishing workshops for parents to support and encourage their children's interest in mathematics and science.
- Ensuring that all mathematics and science activities provide for effective communication with parents with limited English skills.
- Establishing educational programs to help parents become aware of the importance of mathematics and science to their children's futures.[55]

Unfortunately, it is unknown how many school districts are aware of the pamphlet and the brochure, or how many are using the initiatives to include parents in the planning and implementation of mathematics and science curricula and activities.

A 1996 document prepared by OCR's Policy, Enforcement, and Program Service presented approximately 20 "promising" programs and practices that may be helpful to school districts as strategies to enhance the access for women and minorities to mathematics and science. Only two of these programs—the Linking Home and School with Portable, Affordable, Simple Science; and the Mathematics and Science Education Network—include parental involvement as a part of their strategy.[56] For the most part, other federal projects and activities in mathematics and science do not include parental involvement as a component. For example, in January 1994, the Office of Educational Research and Improvement released a report on approximately 50 mathematics, science, and technology programs that have been determined to be successful. None of these programs included parental involvement initiatives.[57]

Investigations and Monitoring

OCR's draft investigative manual,[58] in a section on counseling and guidance services, directs staff to consider parental notification and involvement. OCR staff are instructed to determine: whether parents of females and minorities are notified by and involved with guidance counselors to the same extent as other parents; whether female and minority students and their parents are made aware to the same extent of the availability of upper-level mathematics and science courses; whether parents of female and minority students are included to the same extent when counseling and guidance services are provided to students; and whether the manner in which parents are included in the sessions is similar.[59]

The Commission has found only one OCR letter of finding that requires a school district to

---

[53] Ibid.

[54] OCR, "What Schools Can Do," pp. 2, 21–24.

[55] Ibid., pp. 21–24.

[56] OCR, *Promising Practices*, pp. 4, 20.

[57] U.S. Department of Education, Office of Educational Research and Improvement, *Mathematics, Science & Technology Education Programs that Work: A Collection of Exemplary Educational Programs and Practices in the National Diffusion Network*, 1994, pp. 1–145.

[58] *See* U.S. Department of Education, Office for Civil Rights, "Investigative Manual: Underrepresentation of Females and Minorities in Upper-Level Mathematics and Science in Secondary Schools," draft, August 1994 (hereafter cited as OCR, Draft Investigative Manual, "Females and Minorities in Math and Science").

[59] Ibid., chap. II, p. 3.

include within its voluntary plan parental involvement in mathematics and science.[60] During the 1994–95 school year, OCR's San Francisco Regional Office conducted a compliance review of the Newport-Mesa Unified School District. OCR reviewed whether female and minority students, particularly students with limited English proficiency, have equal opportunity to participate in the school district's upper-level mathematics and science courses.[61] In the review, witnesses pointed out that parental support and interest were critical in the selection of courses. However, OCR found that efforts to reach parents about their children pursuing mathematics and science varied from site to site.[62] As part of its agreement with OCR, the school district agreed to improve communication with parents and encourage parental involvement in course decisions.[63] In particular, the district agreed to review its parent outreach and information practices as part of a comprehensive plan to identify and eliminate barriers and expand opportunities for female, minority, and limited-English-proficient students.[64]

Teachers and Counselors

Major influences on girls' decisions whether to pursue advanced mathematics and science include instruction, interaction, and encouragement from teachers, and guidance from counselors.[65] The participation of girls in advanced mathematics and science is affected by several school-related factors, including lack of teacher encouragement and a shortage of female teachers who are confident about teaching science and mathematics.[66] Moreover, a lack of encouragement from counselors to take college preparatory courses can hinder the participation of girls in advanced mathematics and science.[67]

The Role of Teachers

Educational research suggests that teachers have an effect on students in a variety of ways. Teachers can affect students' achievement through both their abilities and motivational tools, and through the school environment and classroom situations.[68] For example, in a recent article, educational researchers found that having teachers with a degree in mathematics and high ability in math is related to students' higher achievement in math. Conversely, having teachers who do not have a degree in mathematics, or who have lower ability in math, is related to students with lower achievement in math.[69]

In recent years, several influential studies have pointed to interactions between teachers and their students as a major cause of gender-based differences in participation in advanced mathematics and science. In 1994, authors Myra and David Sadker published a book summarizing their past research based on extensive classroom observations. They stated:

> Teachers interact with males more frequently, ask them better questions, and give them more precise and helpful feedback. Over the course of years the uneven distribution of teacher time, energy, attention, and talent, with boys getting the lion's share, takes its toll on girls.[70]

They contended that one of the principal results of what they characterized as "sexist" teaching was girls' lack of interest in mathematics and science.[71] The American Association of University Women (AAUW) also issued a report that argued that "biased" teacher-student interactions in science and mathematics impeded girls'

---

[60] U.S. Department of Education, San Francisco Regional Office for Civil Rights, letter to Dr. Mac Bernd, superintendent, Newport-Mesa Unified School District, California, Jan. 26, 1997, p. 1.

[61] Ibid.

[62] Ibid.

[63] Ibid., p. 5.

[64] Ibid.

[65] *See generally* Myra Sadker and David Sadker, *Failing at Fairness: How Our Schools Cheat Girls* (New York: Simon & Schuster, 1994); OCR, "What Schools Can Do."

[66] *See* Beatriz Chu Clewell and Bernice Anderson, *Women of Color in Mathematics, Science and Engineering: A Review of the Literature* (Washington, DC: Center for Women Policy Studies, 1992), pp. 51–52.

[67] *See* ibid., pp. 52–53.

[68] Brian Rowan, Fang-Shen Chiang, and Robert J. Miller, "Using Research on Employees' Performance to Study the Effects of Teachers on Students' Achievement," *Sociology of Education*, vol. 70 (October 1997), p. 256.

[69] Ibid., pp. 273–74.

[70] Sadker and Sadker, *Failing at Fairness*, p. 1.

[71] Ibid., p. 124.

participation in advanced mathematics and science.[72]

These reports relied on research suggesting that teachers interact differently with girls than with boys, particularly in the areas of mathematics and science.[73] Teachers have been found to have higher expectations for boys' mathematics achievement than they do for girls, especially at the high school level.[74] Teachers often expect girls to be less assertive than male students in advanced mathematics and science, view advanced mathematics and science as male domains, or believe that male students are better in the courses than girls.[75] Research indicates that teachers may communicate sex-role stereotypes, in particular that participation in advanced mathematics and science is not a "female" activity. One expert reports that teachers generally hold strong sex-role stereotypes and often choose the teaching profession in part because they have an aversion to mathematics and science.[76] As a result, teachers may encourage girls less than boys in mathematics and science. Furthermore, the disparity in the numbers of male and female teachers in advanced mathematics and science classrooms and career fields creates a shortage of role models for girls and may lead to the perpetuation of stereotypes. Role models are necessary for girls to promote more gender-equitable learning environments and encourage girls to pursue these areas.[77] Moreover, teacher encouragement affects students' confidence, and studies have found that the influence of teachers may be more important for girls since they tend to receive less encouragement overall to participate in mathematics.[78]

Interactions with teachers and other students often reinforce gender stereotypes and teach girls to defer to others, be passive, and remain silent, which "subvert[s] education" and "robs potential."[79] Research findings also suggest that high-achieving girls may receive the least attention of all students. These girls perceive that they do well because they are lucky or work hard, and not because they are smart or capable.[80] When girls participate in class, rather than interrupting, they often merely acknowledge the comments of other classmates, and are thus perceived as less assertive.[81]

In math and science classes, differences in teaching practices and learning styles can have a large impact. Because boys are taught to experiment and embrace mathematical concepts and theories through action toys and are encouraged by parents and teachers to do so, they are better equipped to understand and enjoy mathematical concepts, scientific experiments, and discussions in math and science classes.[82]

---

[72] American Association of University Women (AAUW), *How Schools Shortchange Girls* (New York: Marlowe & Co., 1992), pp. 121–22.

[73] *See* Jane Butler Kahle, Condit professor of science education, Testimony Before 1994 Hearing, p. 43 (hereafter cited as Kahle testimony); Betty M. Vetter, executive director, Commission on Professionals in Science and Technology, February 1994, *Status of Women Scientists & Engineers in the United States* (Washington, DC: American Association for the Advancement of Science, 1994), attachment to Shirley B. Malcom, head, Directorate for Education and Human Resources Programs, American Association for the Advancement of Science, Testimony Before 1994 Hearing, p. 77. *See also* Ann B. Oaks, "Empowering Women in Mathematics," *Initiatives*, vol. 55, no. 2 (1993), p. 33.

[74] Clewell and Anderson, *Women of Color in Mathematics, Science, & Engineering*, p. 11.

[75] *See generally* Sadker and Sadker, *Failing at Fairness*; Marlaine E. Lockheed and Susan Klein, *Sex Equity in Classroom Organization: Handbook for Achieving Sex Equity Through Education* (Baltimore: The Johns Hopkins University Press, 1991) (hereafter cited as Lockheed and Klein, *Handbook for Achieving Sex Equity*); Myra Moore, Valarie Piper, and Elizabeth Schaefer, "Single-Sex Schooling and Educational Effectiveness: A Research Overview," in U.S. Department of Education, Office of Educational Research and Improvement, *Single-Sex Schooling: Perspectives from Practice and Research* (December 1993) (hereafter cited as Moore et al., "Single-Sex Schooling"); AAUW, *How Schools Shortchange Girls*; Jeannie Oakes, *Lost Talent: The Underparticipation of Women, Minorities, and Disabled Persons in Science* (Santa Monica, CA: RAND, February 1990).

[76] Kahle testimony, p. 43.

[77] Susan McGee Bailey, executive director, Center for Research on Women, Wellesley College, Testimony Before 1994 Hearing, pp. 34–36 (hereafter cited as Bailey testimony).

[78] *See* Clewell and Anderson, *Women of Color in Mathematics, Science & Engineering*, p. 11.

[79] *See* Sadker and Sadker, *Failing at Fairness*, p. 13.

[80] Ibid., p. 50.

[81] *See* Wendy Schwartz and Katherine Hanson, "Equal Mathematics Education for Female Students," *ERIC/CUE Digest*, no. 78 (February 1992); Katherine Hanson, "Teaching Mathematics Effectively and Equitably to Females," Center for Equity and Cultural Diversity Working Paper 1 (Newton, MA: Education Development Center, Inc., 1992), p. 11.

[82] Hanson, "Teaching Mathematics Effectively and Equitably to Females," p. 8. *See also* WEEA Publishing Center, *Gender-Fair Math* (Newton, MA: Education Development Center, Inc., 1995), p. 2; Bridget Murray, "Boys to Men: Emotional Miseducation," *APA Monitor Online*, vol. 30, no. 7

Girls, however, may have more difficulty with math and science concepts because they have not experienced them through other activities, and thus may feel that such concepts have no relevance to their lives. Further, girls may prefer to write about what they have learned, instead of discussing what they know.[83]

Research has found gender disparities in science classrooms. Researchers have noted that teachers have different expectations for students in science class discussions: Boys are spoken to more frequently; boys are asked higher-level questions; teachers elaborate more on boys' responses than on girls' responses; and teachers take boys' arguments on a position more seriously than girls' arguments.[84] Two researchers found that classroom discussions often favor boys, and working in small groups does not facilitate girls' participation, unless they are grouped by gender.[85] The researchers also found that although teachers may not be aware of gender bias in their discussions, students were aware of disparities.[86] These researchers provided several solutions to often unconscious gender bias in teaching. They noted:

> Teachers can encourage girls' participation in discussion by calling on them more often (prompting), restating or elaborating on their remarks, and by giving positive reinforcement for their comments and questions. By doing so, teachers can demonstrate that they value females' participation and take their comments seriously. If the teacher models these behaviors, students may be inclined to emulate them.[87]

The 1997 report of the National Coalition for Women and Girls in Education also found the classroom learning environment to be biased against girls and women. The report stated that males are females were often treated differently, with girls receiving less attention and less praise, as well as less criticism and encouragement.[88] According to the report:

> When males speak, teachers often engage in a dialogue with them, while girls and women are more likely to receive the ubiquitous "uh-huh." College women frequently are interrupted more often and called upon less in many classes. These and other subtle behaviors are often unnoticed by faculty or by students, but they create a chilly climate that dampens female students' ambitions and diminishes their self-esteem and confidence, which in turn, can affect their academic performance.[89]

Similarly, other researchers have reported that "[t]he classroom structure, designed to foster independent non-collaborative thinking, is most supportive of white male, middle-class socialization models, and it continues through university."[90]

Teacher recommendations and referrals play a significant role in placing students in courses. Like placement testing, as discussed in chapter 4, course placement can be susceptible to bias, whether intentional, or more likely, unintentional but nonetheless problematic because it affects educational outcomes. For girls in advanced mathematics and science, teacher bias can have a number of results detrimental to equal participation, particularly continued interest in and pursuit of a college major or future career in mathematics- and science-related fields.

Among the recommendations offered by researchers for removing teacher bias is to train them in the writing of classroom examinations with an emphasis on "writ[ing] tests that are free of sex role stereotyping and that represent activities and occupations as being open to both sexes."[91] According to one author, in addition to being unbiased, teachers must understand their students and understand the contexts in which the student is most likely to be successful in learning.[92]

(July/August 1999), accessed at <http://www.apa.org/monitor/julaug99/youth.html>.

[83] Hanson, "Teaching Mathematics Effectively and Equitably to Females," pp. 8–9.

[84] Barbara J. Guzzetti and Wayne O. Williams, "Changing the Pattern of Gendered Discussion: Lessons from the Science Classrooms," *Journal of Adolescent & Adult Literacy*, vol. 40, no. 1 (September 1996), pp. 38–39.

[85] Ibid., pp. 41–43. *See also* Sue V. Rosser, *Re-Engineering Female Friendly Science* (New York: Teachers College Press, 1997), pp. 16–17.

[86] Guzzetti and Williams, "Changing the Patterns of Gendered Discussion," pp. 43–44.

[87] Ibid., p. 45.

[88] National Coalition for Women and Girls in Education, *Title IX at 25: Report Card on Gender Equity*, 1997, p. 24.

[89] Ibid.

[90] Schwartz and Hanson, "Equal Mathematics Education."

[91] Diamond and Tittle, "Sex Equity in Testing," p. 173.

[92] D. Monty Neill, "Transforming Student Assessment," *Phi Delta Kappan*, vol. 78, no. 1 (September 1997), p. 34.

Research indicates that women who pursue scientific fields at a postsecondary level, such as engineering, state that encouragement provided by teachers while in high school was essential to their career decisionmaking.[93] The AAUW stressed that teachers are the most important "human resource" for encouraging girls to pursue coursework at the high school level that can prepare them for postsecondary careers in technical fields.[94] In addition to using effective teaching strategies, including textbooks, teachers can be catalysts in promoting girls' participation in these subjects by showing fairness in the treatment of all students and enhancing girls' expectations in these subjects.[95]

The Role of Counselors

Counseling services are an essential element of educational programs designed to promote the goals of educational excellence, equity, and equal access in advanced mathematics and science. These services often are critical in shaping students' plans for their futures. Counseling services may include a wide variety of components, such as academic preparation and planning, mental health, interpersonal relations, and career planning.[96] This range of services, if properly designed and implemented, can accommodate the unique developmental needs of girls in elementary and secondary education and maximize their potential in science and mathematics.

However, when appropriate counseling services are not provided, or if counselors' suggestions or opinions are in disagreement with the students' ideas, students can end up being discouraged from their goals and limited in their opportunities. According to OCR:

> The counselor at the secondary school level assumes a number of roles, all important and potentially critical in affecting a student's future. These roles relate in a major way to academic preparation and planning but they also extend to mental health, interpersonal relations, social adjustment, career planning, and work adjustment. In performing these varied roles, the professional commitment of the counselor is directed at promoting the fullest development of each individual.
>
> A variety of barriers has acted to limit this ideal with respect to minorities, women, and handicapped students. These are reflected in the most recent national education statistics. For example, the reading proficiency of minority students, while advancing, is in need of further improvement. The high school completion rates for blacks and Hispanics lag far behind those of white students. Enrollment of minority students in higher education programs is substantially below that of white students. Women and minorities continue to be underrepresented in engineering, mathematics, and other scientific and technical fields.[97]

OCR, thus concludes that "[t]he challenge is to provide counseling services that improve and expand the service delivery to minorities, women, and handicapped students and thereby help to ameliorate these conditions."[98]

As late as 1987, 15 years after the passage of Title IX[99] and 13 years after the passage of the Women's Educational Equity Act,[100] girls still were counseled against taking higher-level math and science courses, frequently foreclosing further study in these core areas.[101] The AAUW has reported that some female high school graduates who have pursued technical fields claim they encountered discouragement from school guidance counselors.[102]

Alarmingly, research suggests that counselors continue to steer women away from careers in math, science, engineering, and technology.[103]

---

[93] AAUW, *How Schools Shortchange Girls*, p. 45 (citing N. Hewitt and E. Seymour, "Factors Contributing to High Attrition Rates Among Science and Engineering Undergraduate Majors," report to the A.P. Sloan Foundation, Apr. 26, 1991, p. 100).

[94] American Association of University Women, *Shortchanging Girls, Shortchanging America: Executive Summary*, 1994, p. 12.

[95] Bailey testimony, pp. 36–37; Kahle testimony, p. 43.

[96] U.S. Department of Education, Office for Civil Rights, *The Guidance Counselor's Role in Ensuring Equal Educational Opportunity*, ED/OCR 91-26R (1991), p. 2 (hereafter cited as OCR, *The Guidance Counselor's Role*).

[97] OCR, *The Guidance Counselor's Role*, p. 2.

[98] Ibid.

[99] 20 U.S.C. §§ 1681–1688 (1994).

[100] 20 U.S.C. §§ 7231–7238 (1994).

[101] Pamela Keating, "Striving for Sex Equity in Schools," in John I. Goodlad and Pamela Keating, eds., *Access to Knowledge: An Agenda for Our Nation's Schools* (New York: The College Board, 1990), p. 97.

[102] *See* AAUW, *How Schools Shortchange Girls*, p. 45.

[103] Charlene Morrow and James Morrow, "Connecting Women with Mathematics," chap. 2, in Pat Rogers and Gabriele Kaiser, eds., *Equity in Mathematics Education: Influences of Feminism and Culture* (Washington, DC: The Falmer Press, 1995); Gerhard Sonnert, *Who Succeeds in*

One author reported that many researchers "believe that high school teachers and counselors still advise young women that [low-ranking colleges] are adequate for them, but that is generally not the case for women aiming for most professions."[104] Many women report that they do not receive adequate career and educational counseling. In a study of women's transitions from school to work, the AAUW found that, to some extent, the women interviewed were not completely satisfied with the guidance they received from guidance counselors. While 37 percent of those whose parents went to college found guidance counselors helpful, only 24 percent of those whose parents did not go to college stated that their guidance counselor was an influential source of information.[105]

Overall, more than one-third of the women surveyed in the AAUW study were very satisfied with the help they received from guidance counselors. However, satisfaction varied, depending on women's experiences with transitions from school to work. Among those who went directly from school to college, only 19 percent were dissatisfied with the guidance they received. Comparatively, 32 percent of the women who worked before entering college were dissatisfied.[106] Noting studies concerned with the large caseloads and high burden of administrative duties faced by guidance counselors, the AAUW report concluded that students in most need of career information and guidance counseling do not receive it.[107] In fact, several students in the AAUW study reported that guidance counselors did not spend sufficient time with them, or provided negative advice, such as telling them what they could not do or telling them their grades were not good enough to get them into college.[108]

School counselors should place emphasis on encouraging girls to consider nontraditional careers, since they are less likely to enter scientific or technical fields than male students.[109] Counselors, as educational resources, can help to eliminate many of the barriers encountered by girls in advanced mathematics and science courses. Many individuals share the responsibility for encouraging girls in advanced mathematics and science. Parents and family members, teachers, and members of the community are major influences for students in making many educational decisions. Counselors, however, are better prepared to serve students in that they can provide additional resources and information that may not be readily available to others. Moreover, counselors are better equipped to assist students with decisions about their academic futures, social and personal problems, and ultimately, career decisions. Congress acknowledges the importance of counselors in providing equal educational opportunities for girls by authorizing financial assistance for programs established for the development of guidance and counseling activities, including career education programs, designed to promote gender equity.[110]

Two studies recommend strategies that can be used by counselors or teachers, including:

> [E]ncouraging girls to take advanced courses in mathematics or science classes, not allowing girls to stop taking mathematics or science courses when they become optional without first discussing the importance of a mathematics and science foundation for their futures, both from an academic and career perspective; discussing with girls their feelings about how they are treated in advanced mathematics and science classes; providing resources and materials on nontraditional occupations to female students; and meeting with counselors of "feeder schools" to make sure that they also are encouraging girls in advanced mathematics and science.[111]

Science? The Gender Dimension (New Brunswick, NJ: Rutgers University Press, 1995), p. 8; Julia Steiny, "Edwatch: Women Overcoming Job Barriers—Yo, girls! Listen up!" *The Providence Journal-Bulletin*, Apr. 5, 1998, p. 1H.

[104] Ambrose, *Journey of Women in Science and Engineering*, p. xi.

[105] American Association of University Women Educational Foundation, *Gaining a Foothold: Women's Transitions Through Work and College*, 1999, p. 53.

[106] Ibid.

[107] Ibid.

[108] Ibid., pp. 54–55.

[109] OCR, "What Schools Can Do"; *see generally* Beatriz Chu Clewell, Bernice Taylor Anderson, and Margaret E. Thorpe, *Breaking the Barriers: Helping Female and Minority Students Succeed in Mathematics and Science* (San Francisco: Josey-Bass Publishers, 1992).

[110] 20 U.S.C. § 7233(b)(2)(B)(ix) (1994).

[111] Jo Sanders, *Lifting the Barriers: 600 Strategies that REALLY WORK to Increase Girl's Participation in Mathematics, Science, and Computers* (Port Washington, NY: Jo Sanders Publications, 1994); Klein et al., "Recommendations for the Continued Achievement of Sex Equity in and through Education," in Lockheed and Klein, *Handbook for Achieving Sex Equity*; Clewell et al., *Breaking the Barrier*, pp. 59–61.

Counselors also can give parents information on providing a gender-equitable environment at home.[112]

Initiatives to Improve Teaching and Counseling Services

There are several federal, state, and local educational programs designed to help eliminate underrepresentation of girls in advanced mathematics and science classes through efforts focusing on teachers and guidance counselors. For example, federal programs under the Women's Educational Equity Act target eliminating gender bias through teacher training.[113] The WEEA authorizes funds to be used for the purposes of "training for teachers, counselors, administrators, and other school personnel, especially preschool and elementary personnel, in gender-equitable teaching and learning practices."[114] The WEEA funds programs that assist teachers in addressing perceptions of gender roles based on cultural differences and stereotypes.[115]

The Dwight D. Eisenhower Professional Development Program provides financial assistance to state and local educational agencies to improve access to high-quality professional development in the core academic subjects that meets state course content and student performance standards.[116] School systems can develop programs for teacher training and education in mathematics and science. For instance, during the 1994–95 school year, the Albuquerque Public Schools received a Title II Eisenhower grant. According to a summary by the school district:

> [T]he Title II Eisenhower grant funded a variety of approaches to science and mathematics teacher enhancement, including both district and on-site teacher training, dissemination of resource materials, and sponsoring of teacher attendance at professional meetings and conferences. The project made use of training received by presenters in other locations in previous years to conduct local workshops, thereby reaching a much larger audience for less cost. The Title II sponsored workshops were attended by 1,568 teachers and provided approximately 16,000 hours of training to teachers.[117]

In recognition of the importance of providing equal educational opportunities for girls in advanced mathematics and science, many states have added questions pertaining to gender issues on their teacher certification examinations.[118] States also have made similar adjustments in teacher education programs. Minnesota, for example, has made an assertive effort to eradicate gender differences in education by requiring all teacher education programs to "foster knowledge and understanding to assure that beginning teachers are aware of and sensitive to handicapping conditions and issues of multicultural education and gender fairness."[119] Initiatives such as these can be effective in promoting gender equity for girls in advanced mathematics and science.

OCR's Enforcement Efforts

Title IX Regulations and Policy

The nondiscrimination provisions of the Title IX regulations do not specifically address teacher education or training with regard to gender equity issues for girls in advanced mathematics and science.[120] Furthermore, OCR has issued no policy guidance on teachers' impact on girls' participation in advanced mathematics and science.

OCR does, however, address counseling services in its Title IX regulations.[121] The Title IX regulations state that schools may not discriminate against any student in "counseling or guidance" based on sex.[122] The regulations also require that counselors use the same test or appraisal materials for both male and female students, unless the materials being used cover the same topic areas and the use of such materials

---

[112] *See generally* Sanders, *Lifting the Barriers*.

[113] 20 U.S.C. §§ 7231–7238 (1994).

[114] 20 U.S.C. § 7233(b)(2)(A)(ii) (1994).

[115] 20 U.S.C. § 7234 (1994).

[116] 20 U.S.C. § 6602 (1994).

[117] Albuquerque Public Schools Resource Center, "Title II (Eisenhower) Project Math and Science Teacher Enhancement Project 1994–95 Summary," p. 1.

[118] Many states, including Minnesota, Wisconsin, and Iowa, have incorporated criteria related to gender equity in their teacher accreditation standards. *See* David Sadker and Myra Sadker, "The Treatment of Sex Equity in Teacher Education," in Lockheed and Klein, *Handbook for Achieving Sex Equity*, p. 150.

[119] Minn. R. 8700.2810 (1997).

[120] 34 C.F.R. Part 106 (1998).

[121] 34 C.F.R. § 106.36(a) (1998).

[122] *Id.*

are found to be essential to eliminating sex bias.[123] The Title IX regulations are an attempt to ensure nondiscrimination in counseling services by requiring that schools implement internal procedures to determine if such appraisal materials discriminate based on gender. In addition, OCR devotes a chapter of its draft investigative manual on underrepresentation to discriminatory counseling and guidance services, although OCR has not issued Title IX policy in finalized form relating to counseling in the area of mathematics and science.

Technical Assistance

OCR's technical assistance brochure, "What Schools Can Do to Improve Math & Science Achievement by Minority and Female Students," offers a number of policies and practices that teachers could use to foster girls' and minorities' participation in advanced mathematics and science.[124] The brochure supports OCR's compliance activities because of its emphasis on educating school districts about the purpose and goals of Title IX generally. It encourages teachers to see their role as important in ensuring gender equity in the development and implementation of advanced mathematics and science programs. The document contains a section on what math and science teachers can do to improve the advanced mathematics and science achievement of girls and minority students. It suggests that teachers should hold high expectations for all students, respond as fully to the comments of minority and female students as to other students, encourage all students to participate, and not assume that assertive male students are more capable than female students. The section notes research indicating that teachers treat male students more positively in all of these areas.[125]

OCR recognizes the importance of nondiscriminatory counseling services in its technical assistance and resource documents. In its resource guidance on counseling, OCR states that "counselors and counseling services are offered by secondary schools and colleges to help students attain their fullest potential academically and socially."[126] Moreover, in recognition of a number of barriers that limit the opportunities of girls in advanced mathematics and science, counseling services can improve and expand the service delivery that helps to alleviate the effects of these barriers.[127] OCR states:

> This means that counselors need to have an understanding of how to recognize discrimination and other barriers to equal educational opportunity before they can take the appropriate steps to enable all students to develop to their fullest.[128]

In one of its technical assistance documents, OCR addresses the underrepresentation of girls and minorities in upper-level mathematics and science in secondary schools. OCR recommends that counselors should:

> (1) hold high expectations for all students; (2) establish a system for the early identification of minority and female students with high interest in mathematics or science; (3) encourage minority and female students to enroll in science and mathematics classes; (4) furnish all students with updated information on careers in mathematics and science; (5) make use of a broader range of professional organizations for career motivational materials and role models; (6) discuss career opportunities with minority and female students in which they have been traditionally underrepresented; (7) help students recognize that economic sufficiency is as important to women as to men; (8) make minority and female students aware that most jobs in the future will require strong math, computer, and science skills; (9) analyze course enrollment data to identify disproportionate enrollment of minority and female students in mathematics and science classes; (10) and monitor minority and female academic achievement and participation in extra curricular math/science activities, including science fairs and clubs.[129]

Compliance Reviews and Complaint Investigations

DOEd asserts that in passing Title IX, Congress did not intend for government regulators to be "routinely placed in the classroom observ-

---

[123] 34 C.F.R. § 106.36(b) (1996).

[124] OCR, "What Schools Can Do."

[125] Ibid., pp. 8–10.

[126] U.S. Department of Education, Office for Civil Rights, "Counseling," Resource Guide Collection Section 627 (Mar. 20, 1996), p. 1.

[127] OCR, "Counseling," p. 1; OCR, Draft Investigative Manual, "Females and Minorities in Math and Science."

[128] OCR, "Counseling," p. 1.

[129] OCR, "What Schools Can Do."

ing teacher/student interaction."[130] Accordingly, OCR's draft investigative manual for cases relating to underrepresentation of females and minorities in advanced mathematics and science classes does not direct OCR investigators to consider whether teachers teach in a biased manner or fail to provide the same encouragement to female students in the areas of mathematics and science as they do for male students.[131] In addition, a review of OCR letters of finding reflects that it has not found a violation of Title IX based on the effects of teacher behavior on girls' participation in advanced mathematics and science.

In its draft investigative manual on the underrepresentation of girls in advanced mathematics and science, OCR states that "high school counselors frequently do not emphasize the wide range of math and science occupations available to girls, and fail to encourage them to keep their options open by pursuing math and science electives."[132]

Another OCR technical assistance document suggests several ways that counselors can avoid "steering girls toward more restrictive career objectives." OCR states that many counselors acquire the most recent employment forecast information and other changes in the labor force. This information, in conjunction with information on the individual abilities and interests of students, will enable counselors to better advise students on their career options. OCR states that some school districts have gone as far as implementing programs to "ensure that counselors are apprised of the most recent occupational outlook data."[133] Another method of expanding career options for girls is arranging workshops to give employers the opportunity to present information to counselors about promising new career fields. Counselors can then disseminate this information to girls who are considering career options or trying to decide on a college major.[134]

Although the manual instructs OCR investigators on how to investigate counseling-related issues, OCR has not found a school district in violation of Title IX in the context of counseling services that deny girls the opportunity to participate in upper-level mathematics and science courses. OCR also has not found a Title IX violation for counseling appraisal materials or resources that have resulted in a "substantially disproportionate number of members of one sex in any subject."[135] One compliance review initiated to determine whether female and minority students had equal opportunity to participate in upper-level mathematics and science courses touched on counseling issues. In identifying some factors that may have contributed to the underenrollment of Hispanic students in college preparatory and advanced mathematics and science courses, OCR noted that "counselors have extremely large caseloads, making it difficult to provide truly individualized counseling and planning for individual students."[136]

Providing Comparable Resources and Equal Access to Technology

Parents, teachers, and counselors play significant roles in education and, subsequently, have the ability to foster gender-equitable learning environments. However, educational resources and materials are also critical to the learning environment. Ensuring equity in access to and content of educational resources is critical for ensuring equal educational opportunities for girls in advanced mathematics and science, particularly because as much as 90 percent of a student's time during school hours is spent using various instructional aids, including textbooks, computers, and videos.[137]

---

[130] *See* Karl Lahring, assistant general counsel, Office of General Counsel, U.S. Department of Education, note to Frederick D. Isler, assistant staff director, Office of Civil Rights Evaluation, U.S. Commission on Civil Rights, July 17, 1997 (re: Civil Rights Commission Initial Draft of Report on Title IX Enforcement), p. 4 (hereafter cited as Lahring note).

[131] *See generally* OCR, Draft Investigative Manual, "Females and Minorities in Math and Science."

[132] *See generally* ibid.

[133] OCR, *The Guidance Counselor's Role*.

[134] Ibid.

[135] 34 C.F.R. § 106.36(b) (1996).

[136] U.S. Department of Education, San Francisco Regional Office for Civil Rights, letter to Dr. Mac Bernd, superintendent, Newport-Mesa Unified School District, California, Jan. 26, 1997, p. 1.

[137] Kathryn P. Scott and Candace Garrett Schau, "Sex Equity and Sex Bias in Instructional Materials," in Lockheed and Klein, *Handbook for Achieving Sex Equity*, p. 218.

Research Studies

Research studies indicate that girls generally do not have equal access to mathematics and science experiences and technology and that many educational resources are gender biased. Research further shows that starting at early ages boys have more hands-on experiences in science and mathematics. One study found that by third grade, 51 percent of boys and 37 percent of girls had used microscopes. By 11th grade, 49 percent of boys and 17 percent of girls had used an electric meter.[138] Girls also have less experience with physical sciences than with life sciences. One commentator on gender differences in mathematics and science said:

> As early as fourth grade, girls show a preference for biological topics, while boys, many of whom have had out-of-school experiences with mechanical and electrical activities, choose topics in the physical sciences. Furthermore, girls base their selections on *what they should know*, while boys select science topics on the basis of *what they want to know*. When science curricula are based on either girls' expressed interests—or on teacher interest—they severely limit girls' education in science, eventually resulting in only 15% of girls enrolling in physics, compared to 25% of boys.[139]

Computers and other technological advances are becoming commonplace in schools, at home, and in the workplace. These advancements are placing new demands on public education. Proponents of gender-fair education are concerned that the educational, societal, and attitudinal factors affecting girls in advanced mathematics and science will be reflected in access to technology.[140] Research on providing equal access to computers and technology suggests that several variables can influence interest in and access to computers for girls in educational settings, including attitudes, environment, and psychological and social factors. These are the same variables that affect enrollment and achievement in advanced mathematics and science courses.[141] In addition, significant patterns are seen between genders with respect to how much time girls spend using computers compared with boys. The research finds that boys spend more time using computers than girls.[142] One study found significant gender differences in access to computers.[143] The study suggested that regardless of the computer availability within a school, girls' access to the technology is far below boys' access. The study indicated that other variables, such as the teacher and the school environment, influence gender inequality in computer use.[144] Also, computers are used differently by particular groups of students.[145] The evidence, in this regard, is inconclusive on the effects of differing usage rates; however, the disparity in the amount of time students are spending using computers can be an indicator of low academic achievement for girls in courses that require computer skills.

Researchers have identified factors that may promote negative attitudes and perceptions by girls toward advanced mathematics and science. For example, several studies report that many textbooks and other resources portray girls and women in stereotypical roles, particularly in science books.[146] Educational literature on gender differences in public education suggests a direct correlation between gender bias in educational resources and materials, and the participation and achievement of girls in various subjects.[147]

Gender-biased text (or illustrations) is broadly defined as an educational resource that

---

[138] Bailey testimony, p. 29.

[139] Kahle testimony, p. 43. *See* AAUW, *How Schools Shortchange Girls*, p. 27.

[140] *See* chap. 2.

[141] June Mark, "Beyond Equal Access: Gender Equity in Learning with Computers," pp. 261–64, in U.S. Department of Education, *Changing Education: Resources for Systemic Reform*, October 1994.

[142] *See generally*, Carole S. Nelson and J. Allen Watson, "The Computer Gender Gap: Children's Attitudes, Performance and Socialization," *Journal of Educational Technology Systems*, vol. 19, no. 4 (1991).

[143] Rosemary E. Sutton, "Equity and Computers in the Schools: A Decade of Research," *Review of Educational Research*, vol. 61, no. 4 (winter 1991), p. 479.

[144] *See* Sutton, "Equity and Computers in the Schools," p. 481 (citing H.J. Becker and C.W. Sterling, "Equity in School Computer Use: National Data and Neglected Considerations," *Journal of Educational Computing Research*, vol. 3 (1987), pp. 289–311).

[145] Henry Jay Becker and Carleton W. Sterling, "Equity in School Computer Use: National Data and Neglected Considerations," *Journal of Educational Computing Research*, vol. 3, no. 3 (1987), p. 289.

[146] *See* Clewell and Anderson, *Women of Color in Mathematics, Science and Engineering*, p. 10.

[147] Charol Shakesaft, "A Gender At Risk: Women in Education," *Phi Delta Kappan*, March 1986; Keating, "Striving for Sex Equity in Schools," p. 91; Scott and Schau, "Sex Equity and Sex Bias in Instructional Materials," pp. 218–28.

consistently portrays boys and girls in traditional or subordinate roles.[148] Many textbooks and other educational material are considered to have overwhelming male-oriented characteristics or to have an imbalance in depictions of men and women in career roles. For example, an educational resource that inaccurately depicts all doctors as boys or all secretaries as girls is gender biased. One commentator, referring to the frequency of such occurrences, stated that "textbooks still send a message that this is what we consider the appropriate role and the appropriate job and the appropriate career for girls and boys."[149]

Another form of gender bias occurs when textbooks or other educational resources use male-generic language.[150] Male-generic language is the use of terms like "he" or "man" when referring to an individual or group of people whose sex is unknown. Other examples include words like "chairman" or "policeman." These biases also exist in educational software, videos, and computer games.[151]

Although today's textbooks and classroom materials are less biased than in the past, sexism and racism can still be found.[152] Further, computer technology materials are "far more regressive than printed texts, which may exacerbate the current male domination of computer science."[153] One researcher noted that some Web sites and advertisements found on the Internet perpetuate gender stereotypes, which has implications for gender equity in schools that use and teach Internet technology.[154] In a review of Web sites, the author found that gender stereotypes were enforced: women were portrayed as subservient or as not using technology in a productive manner.[155] The author noted:

> As schools place more emphasis on incorporating technology into meaningful instructional activities, educators must attend not only to equitable access to technology but also to equitable technology usage in practice. Yet images of male and female roles related to technology continue to be portrayed in stereotypical ways throughout the media, and those stereotypes are often perpetuated subconsciously in classroom practice.[156]

The perceptions that may result from the use of gender-biased resources can influence the academic and career choices of girls in primary and secondary schools. Though some educational resources and materials have been evaluated for gender biases, others have not, and they contain gender biases that can influence girls to make career or academic decisions that do not accurately reflect their own interests and abilities. The literature, in this regard, suggests that students are influenced by, and motivated to learn from, instructional materials and resources that frequently depict their gender in text and illustrations, particularly when the main characters are represented in a positive role. Likewise, educational materials that depict girls in negative roles can have the opposite effect.[157]

Policies and Initiatives

Educators and policymakers share the view that the use of nonbiased curricula materials may have a positive influence on girls in advanced mathematics and science courses. Appropriate nonbiased educational resources can influence girls' academic and career expectations and perceptions, as well as increase their participation and enhance their performance in ad-

---

[148] *See generally* Lucidi, "Gender Equity in Education"; Lockheed and Klein, *Handbook for Achieving Sex Equity*; AAUW, *How Schools Shortchange Girls*; Esther E. Diamond and Carol Kehr Tittle, "Sex Equity in Testing," in Lockheed and Klein, *Handbook for Achieving Sex Equity*.

[149] Bailey testimony, p. 13.

[150] *See generally* Ellen Spertus, *Why Are There So Few Female Computer Scientists?* (Arlington, VA: Office of Naval Research, August 1991).

[151] *See generally* Nelson and Watson, "The Computer Gender Gap."

[152] Denise M. DeZolt and Mary Henning-Stout, "Adolescent Girls' Experiences in School and Community Settings," pp. 253–75, in Norine G. Johnson, Michael C. Roberts, and Judith Worell, *Beyond Appearance: A New Look at Adolescent Girls* (Washington, DC: American Psychological Association, 1999), p. 258.

[153] Patty Henetz and Hilary Groutage, "Addressing Education's Gender Bias," *The Salt Lake Tribune*, Oct. 17, 1998, p. A1. *See also* chap. 2.

[154] Nancy Nelson Knupfer, "Gender Divisions Across Technology Advertisements and the WWW: Implications for Educational Equity," *Theory Into Practice*, vol. 37, no. 1 (winter 1998), pp. 54–63.

[155] Ibid., p. 62.

[156] Ibid., p. 54.

[157] Scott and Schau, "Sex Equity and Sex Bias in Instructional Materials," p. 221.

vanced mathematics and science courses.[158] Though the occurrences of gender biases in educational materials have been lessened in recent years, the emergence of new innovative curricular materials in public education, such as videos and computer software, requires additional evaluation of educational resources and materials.

Congress has recognized the importance of evaluating curricula material by authorizing the WEEA program to provide funding for programs designed to advance gender equity. Among the programs authorized to receive funding are programs for the development and evaluation of model curricula, textbooks, software, and other educational materials to ensure the absence of gender stereotyping and bias.[159] Efforts such as these can prove to be effective in eliminating gender biases in education.

Schools that evaluate instructional resources properly, before their use in the classroom, can encourage girls in advanced mathematics and science courses. School administrators and faculty can filter educational resources that favor one sex over another, and promote the use of educational resources that portray both genders in unique and interesting roles.[160] Evaluating educational material before its introduction in the classroom could help to avoid the use of gender-biased materials, which could diminish girls' self-esteem, lower their performance in advanced mathematics and science courses, and restrict their career options.[161]

Several federal, state, and local educational programs aim to eliminate underrepresentation of girls in advanced mathematics and science classes by focusing on educational resources, including facilities, materials, and technology. These programs improve girls' access to and reduce instances of gender bias in facilities, resources, and educational materials, including computers and textbooks. The Women's Educational Equity Act states that "classroom textbooks and other educational materials [that] do not sufficiently reflect the experiences, achievements, or concerns of women and, in most cases, are not written by women or persons of color" can contribute to teaching and learning practices that are "frequently inequitable."[162] Several WEEA-funded projects have sought to infuse equity into schools' use and teaching of technology. For instance, one WEEA-funded project, Project on Equal Education Rights, developed a kit to assist teachers in ensuring computer equity in the classroom.[163] In addition, under the Eisenhower program, authorized activities include training teachers in achieving gender equity in students' access to computers and other educational technology. Under Title X of the Improving America's Schools Act of 1994, local educational agencies may use awarded funds to develop strategies to eliminate gender bias in instructional materials.[164]

OCR's Enforcement Efforts

Title IX Regulations and Policy

A discussion of OCR's evaluation of schools' Title IX compliance in the provision of resources proceeds along two lines: the regulation of access and the regulation of content. Regarding the content of instructional material and curricula, DOEd asserts that Congress, when it established the Department of Education, expressly prohibited the Department from interfering with state and local decisions about curriculum and the content of textbooks or instructional materials, unless authorized by law.[165] DOEd further states that the legislative history of Title IX reveals a clear intent by Congress to "*exclude* any government review of textbook and teaching materials."[166] Hence, the Title IX regulations them-

---

[158] *See generally* Sadker and Sadker, *Failing at Fairness*; Lockheed and Klein, *Handbook for Achieving Sex Equity*; Moore et al., "Single-Sex Schooling"; AAUW, *How Schools Shortchange Girls*; The Mid-Atlantic Equity Center (MAEC), *The Cost of Sex Bias in Schools and Society*, 1989; Oakes, *Lost Talent*.

[159] 20 U.S.C. § 7233(2)(B)(iii) (1994).

[160] OCR, "What Schools Can Do."

[161] *See generally* Sadker and Sadker, *Failing at Fairness*; Lockheed and Klein, *Handbook for Achieving Sex Equity*; Moore et al., "Single-Sex Schooling"; AAUW, *How Schools Shortchange Girls*; MAEC, *The Cost of Sex Bias in Schools and Society*; Oakes, *Lost Talent*.

[162] 20 U.S.C. § 7231(b)(3)(B) (1994).

[163] *See* "WEEA Computer Equity Materials Aid Teachers," pp. 265–66, in U.S. Department of Education, *Changing Education: Resources for Systemic Reform*, October 1994.

[164] Pub. L. No. 103-382, tit. X, pt. A, § 10101(b)(1)(m), 108 Stat. 3811 (codified at 20 U.S.C. § 8001(b)(1)(m) (1994)).

[165] *See* 20 U.S.C. § 3403 (1994).

[166] *See* Lahring note, p. 3. Two factors render this characterization somewhat suspect: First, OCR's draft investigation manual on underrepresentation of females and minorities recommends review of course content and textbooks in the context of evaluating gender-identifiable classes. *See*

selves do not prohibit the use of gender-biased educational resources or curricular material. The regulations specifically state, "Nothing in this regulation shall be interpreted as requiring or prohibiting or abridging in any way the use of particular textbooks or curricular materials."[167]

As far as access to resources, however, OCR's regulations clearly prohibit discrimination in access to materials. In seeking to provide equal educational opportunities for girls in advanced mathematics and science courses, the Title IX regulations require equal access to course offerings, but do not specifically address providing equal access to technology, although under the Title IX regulations, benefits and services must not be denied or provided differently based on sex.[168] Thus, schools must not discriminate in providing access to instructional materials or technology. OCR has produced no Title IX policy guidance specifically addressing the issue of equal access to facilities, resources, and educational materials such as textbooks and computers for girls in advanced or any other mathematics and science courses at the elementary and secondary levels.

Technical Assistance

Although the Title IX regulations do not require that schools use nonbiased educational resources and materials, OCR has recognized the importance of using such resources and the influence of gender bias in educational materials on girls in advanced mathematics and science education. OCR has therefore developed technical assistance documents on the use of nonbiased educational resources and materials. These technical assistanee materials do not purport to state legal requirements or obligations under Title IX. Nonetheless, these documents and materials are effective in promoting gender equity, equal participation, and equal educational opportunities for girls in advanced mathematics and science.

In its brochure, "What Schools Can Do to Improve Math & Science Achievement by Minority and Female Students," OCR suggests that schools appraise their educational materials to ensure that girls are portrayed in texts and illustrations as involved in scientific and technical careers. This brochure encourages dialogue between teachers and students about resources that may perpetuate stereotypes. In addition, it promotes integrating the contributions of girls in curricula to stimulate their interest in advanced mathematics and science.[169] OCR also recognizes the influences of gender biases in software by indicating that some computer software programs are male oriented and "may lessen the interest and participation of female students in classes where such resources are used."[170] Another technical assistance document, "The Counselor's Role in Ensuring Equal Educational Opportunity," suggests that counselors should use nonbiased career and educational materials when providing counseling services.[171] Finally, a technical assistance document for OCR staff use titled "Equal Opportunity for Minorities and Women to Participate in Math and Science Courses" states with respect to the content of curricular materials:

> The curriculum is an important message-giving instrument of the school. The curriculum can strengthen or decrease student motivation for engagement, effort, growth, and development through messages it delivers to students. Research documents the benefits of gender-equitable materials to students of both sexes. However, research also reveals that although sexism has decreased in some school texts, examples of omission, tokenism, and gender stereotyping still occur frequently in textbook references to girls and women.[172]

OCR Draft Investigative Manual, "Underrepresentation of Females and Minorities in Mathematics and Science," p. I–4. Thus, regulation of content is a valid exercise of OCR's Title IX authority, at least to some extent. Second, two commentators who studied the legislative history of Title IX indicated that OCR had originally drafted its Title IX regulations to include a provision governing sex bias in textbooks, but chose to remove the provision in response to pressure from a university president. *See* Andrew Fishel and Janice Potter, eds., *National Politics and Sex Discrimination in Education* (Lexington: Lexington Books, D.C. Heath & Co., 1977), pp. 111–12.

[167] 34 C.F.R. 106.42 (1998).

[168] 34 C.F.R. §§ 106.1–106.71 (1998).

[169] OCR, "What Schools Can Do."

[170] Ibid.

[171] OCR, *The Guidance Counselor's Role.*

[172] U.S. Department of Education, Office for Civil Rights, "Equal Opportunities for Girls and Women to Participate in Math and Science Courses," March 1993, pp. 8–9.

Initiatives such as these may be useful in expanding career options for girls. OCR also proposes in its technical assistance materials several ways schools can promote equal access to technology, including the use of student sign-up sheets, the use of female tutors in computer courses, and demonstrations of multiple uses for computers, including creative activities.

CHAPTER 7

Structuring Academic Programs to Ensure Gender Equity

To be effective in meeting the educational needs of each student, educational programs must be structured in ways that address: differences across age groups, ability levels, and interests; appropriate curriculum content; and differences in language and family and socioeconomic backgrounds. Moreover, effective educational programs must promote equal educational opportunity for all students, regardless of race, color, national origin, sex, or disability. The structure of educational programs, and mathematics and science programs in particular, is important to the issue of gender equity. How an educational program is structured and the methods behind student placement often define academic success. Indeed, there are differing opinions as to the most effective educational strategies, however, the common basis of all educational theory and practice should be the provision of education that is equitable for all students while at the same time allowing for differences in needs and learning styles.

Recent school reform movements have centered around a variety of issues, including improving academic achievement, raising standards for teachers, increasing funding, allowing teachers to have greater input in the educational process, increasing parental involvement, and in some instances pushing for single-sex schooling.[1] The latter of these reform attempts remains the most controversial, in both educational theory and legal interpretation. Single-sex education, either in the form of sex-segregated classrooms or entire schools, is often referenced in the discussion about the quality of girls' math and science education. However, there are other, more common, educational approaches that can affect girls' participation in rigorous math and science education that also warrant examination, such as grouping and tracking practices.

GROUPING AND TRACKING OF GIRLS IN MATH AND SCIENCE

Ability grouping is the practice of grouping students in a particular instructional setting according to their estimated ability to learn.[2] The fundamental premise of grouping practices is that differential treatment of students with different needs will promote equal educational opportunities for all students.[3] Although grouping and tracking practices are designed to address students' individual needs and maximize educational potential, grouping can also unfairly lock students into academic levels, thereby hampering educational growth. Critics of grouping practices further argue that grouping practices can result in a decline in children's self-esteem and leadership skills.[4] Nevertheless, grouping and tracking practices are used in most elementary

[1] Frank Brown and Charles J. Russo, "Single-Sex Schools, the Law and School Reform," *Education and Urban Society*, vol. 31, no. 2 (February 1999), pp. 145–58.

[2] U.S. Department of Education (DOEd), Office for Civil Rights (OCR), *Annual Report to Congress, Fiscal Year 1991*, p. 19.

[3] Mark G. Yudof, David L. Kirp, and Betsy Levin, *Educational Policy and the Law* (St. Paul: West Pub. Co., 1992), p. 566. *See also generally* U.S. Commission on Civil Rights, *Equal Educational Opportunity and Nondiscrimination for Minority Students: Federal Enforcement of Title VI in Ability Grouping Practices*, Equal Educational Opportunity Project Series, Volume IV, September 1999.

[4] Jeannie Oakes, *Keeping Track: How Schools Structure Inequality* (New Haven, CT: Yale University Press, 1985), p. 33.

and secondary schools and by 63 percent of all teachers.[5]

As the research presented earlier demonstrates, until recently, girls did not participate in mathematics and science programs in the same proportion as boys. Girls have traditionally been discouraged from taking higher-level mathematics and science courses, either indirectly through societal norms, or directly by teachers, counselors, and parents.[6] The discouragement girls often face is manifested in their placement in lower-level courses or their dissuasion from taking upper-level math and science courses. Because placement practices in schools can determine the course of a student's entire education, it is essential that students not be grouped based on erroneously "gendered" assumptions or stereotypical assessments. Schools and communities must work together to ensure within-school grouping practices promote rather than detract from gender equity in math and science.

Few empirical studies have examined gender differences in mathematics and science ability group placement or enrollment of students. Those that have provide mixed evidence as to whether girls or boys are more likely to be placed in higher-level groups in math and science.[7] Nonetheless, some educational researchers have argued that tracking in math and science, and other subjects, can lead to stratification and inequity based on gender.[8]

Standardized tests and other forms of assessment are relied upon to make many "high-stakes" decisions, such as placement in ability groups, placement in mathematics and science classes, and even receipt of scholarships and for college admissions.[9] These assessments may not be appropriate to classify students and determine their course placement, because they test only a narrow range of abilities that lend themselves to standardized testing.[10]

These criteria also tend to highlight the differences between boys and girls. Criteria other than tests, such as previous grades, academic effort, or classroom behavior, are likely used to place students in ability groups.[11] This contributes, in part, to the fact that at earlier grades girls often are more likely to be placed in high-ability groups than boys.[12] However, as indicated earlier, this pattern changes at the secondary education level, when prerequisites become important in determining course placement.

---

[5] Yudof, et al., *Educational Policy and the Law*, p. 572 (citing *Academic Tracking*, Report of the National Education Association Subcommittee on Academic Tracking, 1990).

[6] *See generally* chaps. 2, 4, and 5.

[7] For example, one study, conducted in the late 1980s, examined factors influencing students' placement in elementary school classes in California that grouped students by ability in mathematics. The authors of this study reported that, in general, sex had no effect on a student's likelihood of being placed in a particular ability group. However, among boys and girls with high test scores in mathematics, boys were more likely than girls to be placed in high-ability mathematics groups. Maureen T. Hallinan and Aage B. Sorensen, "Ability Grouping and Sex Differences in Mathematics Achievement," *Sociology of Education*, vol. 60, no. 2 (1987), pp. 67, 71. The sample data for Hallinan and Sorensen's study was a subset of a large, longitudinal data set obtained from a survey of 1,477 students in 48 classes in 10 public and private schools in northern California. Ibid., p. 65. On the other hand, another study of a nationally representative sample of eighth graders examined, among other things, whether boys and girls were in classes of different ability levels, where the ability level of each class was reported by the classroom teacher. The study found girls were more likely to be enrolled in high-ability level classes, and boys were more likely to be enrolled in low-ability level classes. This finding held up even after controlling for students' characteristics, such as mathematics test scores and previous grades, as well as students' behavior, aspirations, and socioeconomic backgrounds. Sophia Catsambis, "The Path to Math: Gender and Racial-Ethnic Differences in Mathematics Participation from Middle School to High School," *Sociology of Education*, vol. 67 (July 1994), p. 202.

[8] *See* Joan Z. Spade, Lynn Columba, and Beth E. Vanfossen, "Tracking in Mathematics and Science: Courses and Course-Selection Procedures," *Sociology of Education*, vol. 70 (April 1997), pp. 108–27. *See also* U.S. Commission on Civil Rights, *Equal Educational Opportunity and Nondiscrimination for Minority Students: Federal Enforcement of Title VI in Ability Grouping Practices*, Equal Educational Opportunity Project Series, Volume IV, 1999.

[9] National Center for Fair & Open Testing, "Testing Our Children: A Report Card on State Assessment Systems," 1997, accessed at <http://www.fairtest.org/states/intro.htm>; National Center for Fair & Open Testing, "State-by-State Study Shows Hundreds More Females Will Win Class of 1999 National Merit Scholarships; Qualifying Exam Changes Forced by FairTest Reduced Gender Bias but Similar Problems on SAT and Grad. Exams Not Yet Addressed," press release, Apr. 21, 1999, accessed at <http://www.fairtest.org/pr/psat4.21.htm>. *See also* chap. 4.

[10] D. Monty Neill, "Transforming Student Assessment," *Phi Delta Kappan*, vol. 78, no. 1 (September 1997), p. 34. *See also* Educational Testing Service, "Too Much Testing of the Wrong Kind; Too Little of the Right Kind," 1999, accessed at <http://www.ets.org/research/pic/testing/tmtoc.html>.

[11] Catsambis, "The Path to Math," pp. 203–04.

[12] Ibid.

One researcher conducting a study on tracking assignments in mathematics found that students who take algebra in the eighth grade are more likely to take calculus in high school.[13] This is an important finding because middle school is the point at which boys' and girls' perceptions about their mathematics abilities begin to change, with a significantly smaller percentage of girls reporting that they had confidence in their math abilities.[14] This percentage continues to widen as girls progress toward high school graduation.[15] By their senior year, this lack of confidence in mathematics and science has translated into girls lagging behind boys in enrollment in the most advanced mathematics and science courses.[16] Further, gender differences persist in the number of girls taking advanced placement (AP) courses in math and science and in scores on AP tests.[17] Gender differences in choice of major and degree completion exist at the college level as well.[18]

OCR's Policy and Investigative Guidance

In its Title IX regulations, the Office for Civil Rights (OCR) has not specifically addressed within-class and between-class pupil placement methods in ensuring nondiscrimination in mathematics and science. OCR has, however, addressed related issues such as general academic course access, admission, enrollment, and effective participation as they relate to discrimination and denial of equal educational opportunity under Title IX. Under Section 106.34 of the Title IX regulations, any organization that receives federal assistance must not: (a) limit admission/access to courses or any other aspect of its educational program to students of one sex; or (b) conduct any educational activity separately on the basis of sex, including health, physical education, business, industrial, vocational, technical, home economics, music, and adult education courses.[19] Section 106.36 prohibits a recipient from discriminating in the use of testing or other materials for counseling students.[20] In addition, where a particular class contains a disproportionate number of individuals of one sex, the recipient must "assure itself [the] disproportion is not the result of discrimination."[21]

Because OCR has not issued formal Title IX policy related to underrepresentation of girls in advanced mathematics and science classes, OCR has no document comprehensively addressing Title IX compliance standards in this area. However, OCR's investigative manual discusses compliance standards related to ability grouping and tracking in mathematics and science under Title IX.

OCR's investigative manual outlines an investigative approach for OCR investigators to follow in cases related to placement of students in advanced mathematics and science courses.[22] In doing so, it provides information on Title IX's compliance standards for ability grouping and tracking in mathematics and science. In particular, for a school district to be in compliance with Title IX, it must not have course scheduling practices that unnecessarily create gender-identifiable classes or sections; it must use appropriate placement criteria and apply them in the same manner to all students; it must ensure placement decisions are made on the basis of

---

[13] Tom Loveless, *The Tracking Wars: State Reform Meets School Policy* (Washington, DC: The Brookings Institution, 1999), pp. 116–17 (citing Elizabeth L. Useem, "Middle Schools and Math Groups: Parents' Involvement in Children's Placement," *Sociology of Education*, vol. 65, no. 4 (October 1992), pp. 263–79); Elizabeth L. Useem, "Getting on the Fast Track in Mathematics: School Organizational Influences on Math Track Assignment," *American Journal of Education*, vol. 100, no. 3 (May 1992), pp. 325–53, quote from p. 341.

[14] *See generally* chap. 2.

[15] Ibid.

[16] Ibid.

[17] Ibid.

[18] Ibid.

[19] 34 C.F.R. § 106.34 (1998).

[20] 34 C.F.R. § 106.36(b) (1998) states: "Use of appraisal and counseling materials. A recipient which uses testing or other materials for appraising or counseling students shall not use different materials for students on the basis of their sex or use materials which permit or require different treatment of students on such basis unless such different materials cover the same occupations and interest areas and the use of such different materials is shown to be essential to eliminate sex bias. Recipients shall develop and use internal procedures for ensuring that such materials do not discriminate on the basis of sex. Where the use of a counseling test or other instrument results in a substantially disproportionate number of members of one sex in any particular course of study or classification, the recipient shall take such action as is necessary to assure itself that such disproportion is not the result of discrimination in the instrument or its application."

[21] 34 C.F.R. § 106.36(c) (1998).

[22] *See* chap. 4.

students' educational needs and not administrative convenience; it must ensure students' academic progress is monitored and students are given opportunities to move across ability groups and tracks; and it must not steer girls away from upper-level mathematics and science classes.[23]

Compliance Reviews and Complaint Investigations

Methods for Investigating Grouping Practices

In conducting targeted compliance reviews to determine whether a school district's placement practices deny girls or minorities equal access to upper-level mathematics and science programs and their prerequisites, OCR staff are directed to consider three primary areas: (1) enrollment patterns, (2) criteria for placement, and (3) monitoring of student progress.[24] In each of these areas, the manual discusses the types of data (e.g., course enrollment patterns by gender) and other information (e.g., school district policies and procedures) and analyses necessary to make a case of gender discrimination or violations of 34 C.F.R. §§ 106.21, 106.31, and/or 106.34, based on disparate treatment or disparate impact.[25]

With respect to enrollment patterns, OCR investigators are directed to look at the school's course offerings; ascertain whether the school has tracks or ability groups in mathematics or science or other courses; and determine whether the school uses ability grouping to place students in classes, sections, or tracks. OCR investigators then must determine whether any of the prerequisite or upper-level mathematics or science courses, tracks, or sequences are gender (or race) identifiable.[26] If girls or minorities are underrepresented in advanced mathematics or science courses, prerequisites, tracks, sequences, or ability groups, then OCR investigators attempt to determine the reasons for the underrepresentation, including the possibility that the scheduling of electives identifiable by race or gender impedes female and minority students' ability to take upper-level mathematics and science classes and the possibility that girls and minorities take prerequisites too late in their secondary school career to permit them to enroll in upper-level mathematics and science classes. OCR investigators also look to see whether different sections of the same course are gender (or race) identifiable and, if so, whether there are differences in course content, teacher certification, or other educational resources across sections.[27]

If, in examining a school's enrollment patterns, OCR investigators find that tracks, sequences, ability groups, courses, or course sections are identifiable by race or gender, they proceed to examine the school's criteria for placement. They determine what criteria are used and whether they are "discriminatory on their face."[28] When a school uses tests in placing students in upper-level mathematics and science classes, OCR investigators must determine whether those tests have been validated for the population being tested and whether they have a known gender (or race) bias. When a school uses subjective criteria, such as teacher recommendations, for placing students, OCR investigators consider whether these criteria are founded in classroom performance or other objective measures or whether they are "unsubstantiated judgments of future potential."[29]

The third area addressed by OCR is determining the extent to which the school monitors students' progress. OCR investigators are directed to determine whether the school's procedures allow for inter-track or inter-group transfer and whether girls and minorities actually move across tracks and groups consistent with the procedures. They also are instructed to ascertain whether girls and minorities are retested periodically to determine if they should be moved, as well as to examine their attrition from upper-level mathematics and science classes.[30]

Although OCR rarely reaches the point in an investigation of requiring schools to justify an educational practice, one OCR attorney ac-

---

[23] *See* U.S. Department of Education, Office for Civil Rights, Investigative Manual: Underrepresentation of Females and Minorities in Upper-Level Mathematics and Science in Secondary Schools, draft, August 1994, pp. I-8 to I-11 (hereafter cited as OCR, Draft Investigative Manual, "Females and Minorities in Math and Science").

[24] Ibid., p. I-1.

[25] Ibid., pp. 4–9.

[26] *See* chap. 4 for a discussion of how OCR determines whether a class is gender or race identifiable.

[27] OCR, Draft Investigative Manual, "Females and Minorities in Math and Science," pp. I-1 to I-2.

[28] Ibid., p. I-5.

[29] Ibid., pp. I-5 to I-6.

[30] Ibid., pp. I-7 to I-8.

knowledged research is beginning to demonstrate there are no benefits to grouping practices and that heterogeneous classrooms are beneficial.[31] In the event that an investigation becomes a possibility, most school administrators are willing to concede that their grouping practices are causing a problem and attempt to remedy the situation.

Cases on Grouping of Girls in Math and Science

A review of OCR's Electronic Library reveals OCR has conducted only a small number of compliance reviews and has received very few complaints alleging ability grouping practices that discriminate against girls and prevent their equal or effective participation in advanced mathematics and science classes. As discussed earlier, OCR has conducted four compliance reviews on the underrepresentation of girls and minorities in advanced mathematics and science classes. Because OCR did not find an underrepresentation of girls in the districts reviewed, the reviews did not examine ability grouping practices that exclude girls from advanced mathematics and science classes. However, the compliance reviews did look at practices that, although not formally ability grouping, resulted in minorities being placed disproportionately in lower-level mathematics and science classes.[32]

SINGLE-SEX EDUCATION

In discussions on gender equity in education, single-sex education has been a critical point of debate. There are a number of issues—educational, social, and legal—relating to the viability of single-sex education. One of the key issues, both from an educational and a civil rights perspective, is whether single-sex education is effective in promoting gender equity, particularly in advanced mathematics and science.

The educational community, including educators, policymakers, and parents, shares a broad consensus that ensuring gender equity and equal participation is an important goal in the structuring, development, and implementation of educational programs. Disagreement in the educational community has arisen, however, on the issue of how best to provide gender equity, equal access, and equal participation. Though the school door may be wide open for girls to pursue the curricula of their choice, some contend an open-door policy cannot by itself result in gender equity in educational programs such as advanced mathematics and sciences. Opinions vary greatly as to how urgent the situation really is, particularly for girls who are racial or ethnic minorities. However, growing concern among stakeholders in the educational community over student achievement and participation in advanced mathematics and science courses in secondary school, as well as students' choices of college majors and their career aspirations, has led some educators and policymakers to consider single-sex schools as a viable alternative to the prevailing coeducational system.

Single-sex educational programs are the focal point of a long-term controversy over how the sometimes differing needs of boys and girls can be met in public elementary and secondary schools. Debate is ongoing surrounding the educational effectiveness, the social implications, and even the legality under the U.S. Constitution, Title IX, and the Equal Educational Opportunities Act, of separating the sexes in educational settings.

Some opponents of single-sex education view it as a misogynistic desire to perpetuate gender stereotypes of girls and women as more submissive and less capable and competent than their male counterparts. Others oppose single-sex education because of its questionable constitutionality. The introduction of public funds into the dispute highlights and aggravates all other criticisms, because it legitimizes an educational method grounded in segregating on the basis of sex.

However, others argue there is a strong need for a careful and objective review of the potential benefits of single-sex education, both as a method of educational reform and as an expression of educational diversity. While school systems are overwhelmingly coeducational, advocates of single-sex education argue they are only suggesting an alternative to, not a replacement for, coeducational settings. They argue further that the goal of exploring the single-sex option is to present an educational environment in which students can choose that which is most closely tailored to the way they learn, thereby maximizing their academic potential.

---

[31] *See* Steve Deering, team leader, David Rolandelli, equal opportunity specialist, and Louise Bonanova, equal opportunity specialist, Office for Civil Rights, Region IX, U.S. Department of Education, telephone interview, June 25, 1996.

[32] *See* chap. 4.

The Debate over Single-Sex Education

The Case for Single-Sex Education

Proponents of single-sex educational programs argue these programs have demonstrated positive results based on a number of relevant criteria. These include positive results for academic outcomes; intellectual and emotional self-esteem; socialization; an awareness of the problems created by sexist behaviors, perceptions, and attitudes, including sex-role stereotyping; and faculty-student interaction.[33] According to one legal scholar, there are three primary interests furthered by publicly supported single-sex education: excellence in education, a self-confident citizenry with well-developed leadership skills, and systemwide diversity in education.[34]

One researcher found that girls in single-sex schools outscore girls in coeducational schools by a full half grade in four general academic ability tests, and by a full grade level in such nontraditional female fields as mathematics, science, and engineering.[35] The absence of male peers from the classroom appears to create a more focused, more academically oriented, less pressure-filled atmosphere for many girls. As a result, while, in general, adolescent girls may strive to conceal their academic successes for fear of intimidating boys, girls in single-sex schools are more likely than those in coed schools to want others to remember them foremost as brilliant students.[36]

Advocates of public single-sex education also argue single-sex schools promote qualities such as self-confidence and leadership in girls.[37] In addition, further research indicates that girls can thrive with the assistance of supportive mentors, and girls often rely on role models to a greater degree than boys.[38] Single-sex schools provide a unique opportunity for girls to interact regularly with role models and mentors. Accordingly, single-sex schools with positive role models, combined with the increased attention they receive from their teachers, can enhance girls' sense of self-worth and competence.

One legal commentator argues the need for educational diversity is particularly important in the context of research demonstrating the differences between boys and girls in learning styles and behavioral and other development.[39] The best possible educational system would be one in which academic programs are designed exclusively for each individual, addressing problems, encouraging strengths, and respecting differences. The most effective way to approach this ideal, however, is by making general classifications based on the needs common to the greatest number of students. The best way to isolate individuals by their particular developmental and educational needs is by gender, which is the primary determinant of learning differences.[40]

According to advocates of single-sex education, there is proof that separating by gender does advance important educational goals, particularly if one accepts the notion of inherent gender differences. Another commentator who advocates single-sex educational programs on legal and educational grounds suggests that there are psychological and physiological differences between males and females and therefore the Constitution tolerates laws that discriminate between the sexes.[41] This view suggests that it therefore makes sense to address the unique educational problems facing girls as a group

---

[33] *See generally* U.S. Department of Education, Office of Educational Research and Improvement, *Single-Sex Schooling: Proponents Speak*, vol. II (reprinted February 1997).

[34] Kristen S. Caplice, "The Case for Public Single-Sex Education," *Harvard Journal of Law and Public Policy*, vol. 18, no. 227 (1994), pp. 241–55.

[35] *See generally* Cornelius Riordan, *Girls and Boys in School: Together or Separate?* (New York: Teachers College Press, 1990).

[36] Emmanuel Jimenez and Marlaine E. Lockheed, "Enhancing Girls' Learning Through Single-Sex Education: Evidence of a Policy Conundrum," *Education Evaluation & Policy Analysis*, vol. 11 (summer 1989).

[37] Caplice, "The Case for Public Single-Sex Education," p. 248. *See also* Amanda Elizabeth Koman, "Urban, Single-Sex, Public Secondary Schools: Advancing Full Development of the Talent and Capacities of America's Young Women," *William and Mary Law Review*, vol. 39 (January 1998), pp. 507–55 (citing Rosemary C. Salomone, "All-Girls School for Spanish Harlem? Yes," *New York Law Journal*, Aug. 5, 1996, p. 2).

[38] Nanci M. Monaco and Eugene L. Gaier, "Single-Sex versus Coeducational Environment and Achievement in Adolescent Girls," *Adolescence*, fall 1992, p. 581; American Association of University Women (AAUW), *Growing Smart: What's Working for Girls in Schools*, 1994; American Association of University Women, *Girls in the Middle: Working to Succeed in School*, 1996, pp. 86–87.

[39] *See* Caplice, "The Case for Public Single-Sex Education," p. 261.

[40] Ibid., p. 253.

[41] Jon Allyn Soderberg, "The Virginia Military Institute and the Equal Protection Clause: A Factual and Legal Introduction," *Washington and Lee Law Review*, vol. 50, no. 15 (1993), p. 20.

through the development and implementation of an alternative such as single-sex education.

The experience of female students in public elementary and secondary schools is unique. What other group starts out ahead—in reading, writing, and even math—and 12 years later finds itself behind? Advocates for single-sex education argue compensatory education exists for those who enter school at a disadvantage; it is time to recognize the problems of those who lose ground as a result of their years in schooling.

The Case against Single-Sex Education

While some studies support the assertion that single-sex schools provide benefits, others note that all single-sex schools are not equal in providing a productive learning environment. Opponents of single-sex education argue that many factors contributing to the success of effective single-sex schools are fundamental to effective schools regardless of their gender policy: a small student body, strong emphasis on academics, and commitment to the school's mission and values.[42] Proponents of coeducation argue single-sex schools may in fact perpetuate stereotypes, do not solve the gender-bias problem, and are questionable in terms of legality.[43] Although some believe single-sex settings may help avoid gender bias and the distractions of coeducational classrooms, some experts question whether they are the best remedy. They acknowledge the urgent problems single-sex programs are meant to solve, but also express concerns about the risk of a separate and unequal allocation of educational resources and the reinforcement of stereotypes.[44]

The view that same-gender schools may accrue positive outcomes, particularly for young women, is seen to be somewhat inconclusive by proponents of coeducation. In fact, the American Association of University Women (AAUW) released a report in 1998 stating that there is no evidence that single-sex education generally is better than coeducation. The report states that the success of any single-sex educational setting is "relative to a particular group of students in a particular setting and a given set of academic or social objectives."[45] Further, the long-term effects of single-sex education remain unknown.[46]

With coeducation now virtually the norm in public elementary and secondary schools, a critical perspective is emerging that depicts these schools as environments that socialize young men and women into a society stratified by gender. According to one study, classrooms are primary sites for the development of socialization considered sexist.[47] However, opponents of single-sex education argue that this remains true in all educational settings. One study found that research has not conclusively identified single-sex education as a solution to gender bias.[48] This study investigated how gender socialization operates in three types of independent schools: boys' schools, girls' schools, and coeducational schools. The researchers collected observational data on 86 classrooms in 21 schools in different curricular areas. The study found teachers played a role in introducing various behaviors and attitudes associated with sexism: gender reinforcement, embedded discrimination, sex-role stereotyping, gender domination, active discrimination, and explicit sexuality.[49] Furthermore, although the frequency of incidents was similar in the three types of schools, the forms of

---

[42] *See generally* U.S. Department of Education, Office of Educational Research and Improvement, *Single-Sex Schooling: Perspectives from Practice and Research*, OR-94-3152, vol. 1 (reprinted, February 1997).

[43] *See* Wendy Kaminer, "The Trouble with Single-Sex Schools; All Female Schools Help Women Get Into the Professions While Reinforcing Sex Differences," *The Atlantic Monthly*, vol. 281, no. 4 (April 1998), p. 22; Nancy Levit, "Separating Equals: Educational Research and the Long-Term Consequences of Sex Segregation," *George Washington Law Review*, vol. 67 (March 1999), pp. 451-525.

[44] U.S. General Accounting Office, *Public Education: Issues Involving Single-Sex Programs and Schools*, May 1996, p. 6 (hereafter cited as GAO, *Issues Involving Single-Gender Schools and Programs*).

[45] American Association of University Women, *Separated by Sex: A Critical Look at Single-Sex Education for Girls*, 1998, pp. 2, 22-34. The AAUW's widely publicized 1992 publication, *How Schools Shortchange Girls*, was often interpreted as advocating single-sex education. The AAUW decided, as a result of the increased interest in girls' education, to compare research findings on single-sex education in an attempt to assess the effectiveness of this educational approach. The finding, which may be surprising given the AAUW's previous publications, was that single-sex education is not necessarily the solution for gender inequity in education.

[46] Ibid., p. 3.

[47] Valerie E. Lee, Helen M. Marks, and Tina Byrd, "Sexism in Single-Sex and Coeducational Independent Secondary School Classrooms," *Sociology of Education*, vol. 67 (1994), pp. 92-120.

[48] *See generally* ibid.

[49] Ibid., pp. 102-03.

sexism were different. In coeducational schools, chemistry classes had the highest incidence of sexism. The most severe form of sexism overall was found in boys' schools. Although girls' schools exhibited the most gender-equitable events (conscious effort to provide equitable education for both sexes), they also perpetuated a degree of sexism.[50]

The study indicated gender norms in schools vary across and within institutions. Since the frequency of sexism was roughly equivalent across the three types of schools, neither coeducation nor single-sex schooling was exonerated. The variation in the nature and severity of incidents in the different types of schools suggests some conclusions about the importance of gender organization in both the prevalence and characteristics of classroom engenderment.[51] Proponents of coeducation refer to this study when discussing the inconclusive evidence that supports single-sex education as the solution to gender bias. Some believe successful strategies used in single-sex settings—smaller classes and more individual attention—can be just as effective in coeducational settings. They believe teacher training in diversity and equity can also contribute to a bias-free coeducational classroom. Finally, some experts caution that separating the sexes should not be viewed as a simple solution to complex problems, and the program goals, content, and desired outcomes must be carefully scrutinized.[52]

Single-sex education advocates argue that single-sex schooling expands the diversity of the educational system by providing students with an option more closely tailored to their developmental and learning needs. Critics of this argument suggest it is disingenuous at best to characterize a school that categorically excludes one sex as a setting that facilitates diversity in any meaningful way.[53] Another criticism of single-sex education as a means of achieving diversity is that the "diversity" objective could be used to justify just about any discriminatory admissions policy. The argument suggests that if one believes excluding one gender is a means of achieving diversity, one can only imagine how much more diversity a state could acquire by excluding one race or ethnicity.[54]

A great deal of literature, particularly by legal commentators in law reviews and journals, has caused comparisons between discrimination on the basis of race and discrimination on the basis of sex.[55] As a result of this parallelism, schools that are separated on the basis of sex often have been criticized for the same reasons that racially segregated schools have been found unconstitutional.[56] Proponents of coeducation refer to the U.S. Supreme Court decision in *Brown v. Board of Education* for the sociological and psychological evidence that rejects the "separate but equal doctrine"[57] as it applies to both racial and gender segregation in schools.

Finally, the validity of single-sex research is often called into question due to methodological problems, and gender bias seems to exist in both types of schools. Accordingly, some critics contend single-sex education is not the successful educational method its proponents portray.[58] These critics maintain the case for single-sex education has been built largely on the basis of observations made of private single-sex schools, which provide an entirely different environment from that of large, urban public schools. Critics point out that single-sex private schools are usually much smaller than public schools, with small classes, low student-faculty ratios, specialized curricula, and well-endowed programs and facilities. In addition, students enrolled in such fee-charging private schools are likely to come from more advantaged backgrounds. Fi-

---

[50] Ibid.

[51] Ibid., p. 113.

[52] *See generally* GAO, *Issues Involving Single-Gender Schools and Programs.*

[53] Caplice, "The Case for Public Single-Sex Education," p. 252.

[54] Bennett L. Saferstein, "Revisiting Plessy at the Virginia Military Institute: Reconciling Single-Sex Education with Equal Protection," *University of Pittsburgh Law Review*, vol. 54 (1993), pp. 637, 641, 653.

[55] *See e.g.*, Lisa K. Hsiao, "Separate but Equal Revisited: The Detroit Male Academies Case," *1992/1993 Annual Survey of American Law*, vol. 85 (1992–93); Cynthia Lewis, Comment, "Plessy Revived: The Separate but Equal Doctrine and Sex-Segregated Education," *Harvard Civil Rights Law Review*, vol. 12 (1977), pp. 585–94.

[56] Lewis, "Plessy Revived," p. 594.

[57] 347 U.S. 483, 493–94 (1954).

[58] Hsiao, *Separate but Equal Revisited*, p. 85; *see generally*, Fred A. Mael, "Single-Sex and Coeducational Schooling: Relationships to Socioemotional and Academic Development," *Review of Educational Research*, vol. 68, no. 2 (summer 1998), pp. 101–29; Kaminer, "The Trouble with Single-Sex Schools."

nally, private schools are likely to be highly selective. Therefore, problems of internal and external validity hamper many studies of single-sex education.[59] Issues of particular concern are selection bias in the sample used (an issue of internal validity) and the ability to generalize findings drawn from private schools to public schools or samples of convenience (issues of external validity).

Finding Middle Ground in the Single-Sex Debate

While there will always be debate centering around the pros and cons of single-sex education, there are many lessons that can be learned by studying those programs that have been successful in improving girls' participation in all curricula, and particularly in math and science. Perhaps, rather than expending valuable energy debating the issues, educators should focus on developing curricula in elementary and secondary education that emphasize equitable opportunities within all classrooms and in all academic subjects through the integration of innovative teaching techniques and gender-neutral practices in the coeducational setting. As one educator stated:

> Children all have special characteristics, strengths, interests, and challenges. What is the best approach for one is invariably not the best for all. Thus, from a policy perspective, a discussion of what is best for children requires flexibility, and not rigidity.[60]

While it must be emphasized that not all girls learn in the same manner, there is some evidence suggesting that girls achieve higher scholastic achievement, particularly in math and science, when taught differently from boys.[61] Some students learn more efficiently in cooperative environments and others learn more in competitive settings; students' achievements depend on which learning styles teachers use in the classroom.[62] For example, some educational researchers postulate that girls learn better in group settings where there is a great deal of interaction and boys learn better in more competitive and individualistic settings. In today's schools, students who learn well in competitive situations may fare better, since these environments predominate. Others suggest that males and females differ in preferences for learning environments that involve active versus more sedentary learning, working independently or with the teacher's assistance, and using numbers and logic.[63]

Educational experts have raised the question of how teachers can combine a variety of instructional approaches to meet the diverse learning needs of any group of students.[64] Research suggests that for mathematics and science taught in mixed classes, a variety of instructional approaches is critical to meet the learning needs of boys and girls. The usefulness of this educational theory is not limited to the coeducational setting, as it would hold true for single-sex classes as well. Even within single-sex classes and single-sex schools there will most likely still be a range of learning styles represented, which demand varied instructional approaches.[65]

Instructional ideas that emerge from single-sex schools and classrooms could have relevance for coeducational environments and should encourage discussion among educators.[66] Discussions about single-sex education often pit those in coeducational settings against those who are in single-sex environments, rather than fostering collaboration. The 1998 AAUW report advocates the notion that those factors that create positive results in the single-sex environment also exist or can be reproduced in coeducational settings.[67] Further, some educators believe that an unfair burden of proof is placed on single-sex schools to prove their effectiveness, while coeducational schools are rarely asked to prove their

---

[59] DOEd, *Single-Sex Schooling: Perspectives from Practice and Research*, pp. 7, 71. *See also* Levit, "Separating Equals," pp. 503–12; Mael, "Single-Sex and Coeducational Schooling."

[60] Beth J. Lief, "A Symposium on Finding a Path to Gender Equity: Legal and Policy Issues Raised by All-Female Education," *New York Law School Journal of Human Rights*, vol. 14 (1997), pp. 2–3.

[61] *See* discussion on Learning Styles in chap. 2.

[62] Herbert Grossman and Suzanne H. Grossman, *Gender Issues in Education* (Boston: Allyn and Bacon, 1994), p. 21.

[63] Ibid., p. 22.

[64] Anne M. Seitsinger, Helen C. Barboza, and Anne Hird, "Single-Sex Mathematics Instruction in an Urban Independent School," paper presented at the annual meeting of the American Educational Research Association, April 13–17, 1998 in San Diego, CA.

[65] Seitsinger et al., "Single-Sex Mathematics," p. 15.

[66] DOEd, *Single-Sex Schooling: Perspectives from Practice and Research*, pp. 72–73.

[67] AAUW, *Separated by Sex*, pp. 2, 34.

effectiveness.[68] Many urge that no single educational format is appropriate for all women or all men, and a range of instructional formats is most likely to prove effective in addressing different learning styles. According to the Department of Education:

> To expand the dialogue to a broader group of educators, the educational community should launch efforts to consider a wide array of outcomes that apply equally to coeducational and single-sex environments. For example, attention should focus not only on results of cognitive tests, but also on students' career accomplishments, sense of personal efficacy, ideas of competence and success, and on ways to avoid such detrimental behaviors as dropping out of school, teenage pregnancy, drug and alcohol abuse, and delinquency. Educators and researchers should also explore and debate how differences in schools' sense of purpose, pedagogy, staff, curricula, and level of parental involvement relate to these student outcomes across coeducational and single-sex settings.[69]

To incorporate differing learning styles in mathematics, for example, an emphasis should be placed on understanding rather than memorizing, on communicating mathematics, and on doing mathematics in context.[70] Strategies to make mathematics (and science) education more accessible for female students include:

- Looking at the experiences of female students on a regular basis.
- Looking for the valuable aspects of female approaches to learning mathematics.
- Developing a supportive professional climate for examining and challenging existing gender roles.
- Believing that female students thrive on intellectual challenge and that they deserve to be supported.
- Making sure that educational structures (group work, etc.) instruct students on sharing tasks and time equitably.[71]

Other educators have proposed strategies for making all subjects more gender equitable, such as increasing assigned readings that focus on female experiences, ensuring that science texts depict girls doing experiments as well as boys, and evaluating history texts for whether they portray a complete history with women playing critical roles.[72]

Another alternative to single-sex schooling could be enhanced equity training for teachers.[73] Teachers must understand the differences in learning styles and hence teaching techniques among and between groups of students. In addition, teachers must recognize the differences in male-female learning styles as they exist in specific ethnic and socioeconomic groups, and they must develop a way of determining which students do not conform to the "norms."[74] A number of effective math and science programs have built upon this idea of altering teaching methods to improve the quality of girls' learning in these subjects, and have assisted teachers in accommodating their instructional techniques to the learning and behavioral styles of their female students.[75] These programs should be replicated in both single-sex and coeducational schools to ensure improved math and science participation and performance of female students.

Federal Law on Single-Sex Education

Title IX of the Education Amendments of 1972

Whatever the desirability for its proponents, single-sex education remains limited by federal and some state and local laws. Title IX of the Education Amendments of 1972 sought to address the inequities faced by girls and women in educational programs and employment in education.[76] Title IX protects both students and employees from discrimination based on sex in educational programs or activities that receive federal financial assistance. Title IX states:

---

[68] Ibid.

[69] Ibid.

[70] Charlene Morrow and James Morrow, "Connecting Women with Mathematics," in Pat Rogers and Gabriele Kaiser, eds., *Equity in Mathematics Education: Influences of Feminism and Culture* (Washington, DC: The Falmer Press, 1995), p. 23.

[71] Ibid., p. 25.

[72] Florence L. Denmark, "Enhancing the Development of Adolescent Girls," in Norine G. Johnson, Michael C. Roberts, and Judith Worell, eds., *Beyond Appearance: A New Look at Adolescent Girls* (Washington, DC: American Psychological Association, 1999), p. 379.

[73] Mael, "Single-Sex and Coeducational Schooling," p. 113.

[74] Grossman and Grossman, *Gender Issues in Education*, p. 132.

[75] Ibid., pp. 144–45.

[76] Pub. L. No. 92-318, 86 Stat. 235 (codified as amended at 20 U.S.C. §§ 1681–1688 (1994)).

No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance . . .[77]

Title IX's prohibition of discrimination in admissions and recruitment is limited to the following recipients: institutions of vocational education, professional education, graduate higher education, and public institutions of undergraduate higher education unless they traditionally and continually from their establishment have had a policy of admitting only students of one sex.[78] The statute also exempts certain educational programs from its coverage, including educational institutions controlled by religious organizations, educational institutions whose primary purpose is the training of individuals for military service, and the membership practices of social fraternities and sororities exempt from taxation.[79]

Equal Educational Opportunities Act

The Equal Educational Opportunities Act (EEOA), a federal civil rights statute enacted in 1974, prohibits state and local educational agencies from deliberately segregating students on the basis of race, color, or national origin.[80] The statute provides in relevant part:

No state shall deny equal educational opportunity to an individual on account of his or her race, color, sex, or national origin by

(a) the deliberate segregation by an educational agency of students on the basis of race, color, or national origin among or within schools; . . . [or]

(c) the assignment by an educational agency of a student to a school, other than the one closest to his or her place of residence within the school district in which he or she resides, if the assignment results in a greater degree of segregation of students on the basis of race, color, sex, or national origin among the schools of such agency than would result if such student were assigned to the school closest to his or her place of residence within the school district of such agency providing the appropriate grade level and type of education for such student . . .[81]

Section (a), which prohibits "deliberate segregation by an educational agency" as a practice that denies equal educational opportunity, only refers to race, color, and national origin and fails to include sex among these classifications.[82] This language indicates that Congress chose not to summarily prohibit sex-segregated schools. Section (c) prohibits any assignment of students that results in a greater degree of segregation on the basis of race, color, sex, or national origin than would result if the student were assigned to the school closest to his or her home.[83] However, the section's use of the term "assignment" indicates that while a school system may not assign a student in a way that would have the effect of segregating the student population, a student may choose to attend a school at which he or she may be underrepresented. Taken together, the two sections suggest a congressional intent to allow sex-segregated schools where attendance at such schools is voluntary.[84]

Equal Protection Clause

The Equal Protection Clause of the 14th Amendment to the United States Constitution also limits single-sex education.[85] It prohibits a state from denying a person under its jurisdiction the equal protection of the laws.[86] Equal protection dictates that members of certain protected classifications, such as race, color, sex, and national origin, may not be denied the rights of other citizens based on their membership in these groups. Because the Constitution is the supreme law of the land,[87] no law, regulation, or

---

[77] 20 U.S.C. § 1681(a) (1994). *See also* 34 C.F.R. § 106.31 (1998).

[78] 20 U.S.C. § 1681(a)(5) (1994).

[79] 20 U.S.C. § 1681(a)(3), (4), (6) (1994).

[80] Pub. L. No. 93-380, tit. II, pt. A, § 204, 88 Stat. 515 (codified at 20 U.S.C. § 1703(a) (1994)).

[81] *Id.* at § 1703(a), (c) (1994).

[82] 20 U.S.C. § 1703(a) (1994).

[83] *Id.* at § 1703(c) (1994).

[84] *See* Caplice, "The Case for Public Single-Sex Education," pp. 269–71. *See also* Daniel Gardenswartz, "Public Education: An Inner-city Crisis! Single-Sex Schools: An Inner-City Answer?" *Emory Law Journal*, vol. 42 (spring 1993), p. 591.

[85] *See, e.g.*, Mississippi University for Women v. Hogan, 458 U.S. 718 (1982) (striking down as unconstitutional the all-female admissions policy of a nursing program at a state-run university); United States v. Virginia, 518 U.S. 515 (1996) (striking down as unconstitutional the all-male admissions policy of a public military college).

[86] U.S. CONST. amend. XIV, § 1.

[87] *See* U.S. CONST. Art. VI.

policy promulgated by a public entity may conflict with equal protection principles. Thus, OCR's regulations, policies, and procedures enforcing Title IX and the Equal Educational Opportunities Act must operate within the legal constraints imposed by the Equal Protection Clause.

Over the last century, the U.S. Supreme Court has developed a framework for evaluating laws and policies that treat members of protected classifications differently. It scrutinizes these laws in accordance with constitutional standards of review. For example, the Court applies the "strict scrutiny" standard of review, which is the most rigorous test, to government action that singles out citizens based on race. Under this standard, if government action is not narrowly tailored to serve compelling state interests, it will violate the Equal Protection Clause. For scrutinizing laws or policies that are alleged to discriminate based on sex, the Court has developed a lower tier of analysis called "intermediate scrutiny."[88] Under intermediate scrutiny, the law or policy that treats persons differently based on sex must be substantially related to an important government interest.[89] Although the intermediate level of scrutiny is easier to withstand than strict scrutiny, the Supreme Court has strengthened the test since its establishment in 1976,[90] and it is becoming harder for public single-sex schools to meet Equal Protection Clause requirements.

The Supreme Court's interpretation of equal protection in relation to single-sex education remains substantially undefined. The Court has used the Equal Protection Clause to strike down the single-sex admissions policies of two public undergraduate institutions,[91] but has not ruled explicitly on the constitutional permissibility of single-sex schools and classes at the elementary and secondary levels.[92]

Case Law Relevant to Single-Sex Education

The interaction among equal protection, Title IX, and the EEOA can be a source of confusion. There have been seemingly conflicting decisions in the courts as to the legality of single-sex programs.[93] For this reason, it would be appropriate for OCR to develop guidance for students, teachers, parents, and school administrators to clarify the duties imposed on educational institutions by the Equal Protection Clause, Title IX, and the EEOA. A discussion of case law relevant to single-sex education sheds light on the equal protection constraints imposed on OCR in its enforcement of Title IX.

Single-Sex Schools at the Postsecondary Level. Under Title IX, vocational institutions, graduate institutions, professional institutions, and public undergraduate institutions (unless traditionally single sex) must not limit admissions based on sex.[94] Private undergraduate institutions are exempted.[95] The EEOA does not apply to postsecondary schools.[96]

In the 1982 case of *Mississippi University for Women v. Hogan*[97] the Supreme Court explicitly addressed the constitutionality of sex-based standards for admission to educational institutions. In *Hogan*, a male who was refused admission to the all-female nursing program at the Mississippi University for Women sued under equal protection.[98] There were other state nursing schools available to the plaintiff, but he would have had to commute a substantial distance to attend any of them.[99] Applying the intermediate level of scrutiny, the Court invalidated the all-female admission policy, finding that the policy was not substantially related to

---

[88] *See, e.g.*, Mississippi Univ. for Women v. Hogan, 458 U.S. 718 (1982); Michael M. v. Superior Court, 450 U.S. 464 (1981); Orr v. Orr, 440 U.S. 268, 279 (1979); Califano v. Goldfarb, 430 U.S. 199 (1977); Califano v. Webster, 430 U.S. 313 (1977); Craig v. Boren, 429 U.S. 190 (1976).

[89] The court used this standard in the case of Craig v. Boren, 429 U.S. 190 (1976), in which it stated that "to withstand Constitutional challenge . . . classifications by gender must serve important governmental objectives and must be substantially related to achievement of those objectives." *Id.* at 197.

[90] *See* Hogan, 458 U.S. at 718; United States v. Virginia, 518 U.S. at 515.

[91] *See* 458 U.S. at 718; 518 U.S. at 515.

[92] *See* GAO, *Issues Involving Single-Gender Schools and Programs*, p. 11.

[93] *See* discussion below. It should be noted that OCR has, however, issued letters of finding and correspondence discussing the compliance standard related to single-sex education.

[94] *See* 20 U.S.C. § 1681(1)(a) (1994 & Supp. III 1997); 34 C.F.R. §§ 106.15(c)–(e), 106.21(a) (1998).

[95] *See* 20 U.S.C. § 1681(1)(a) (1994 & Supp. III 1997).

[96] *See* 20 U.S.C. § 1703 (1994 & Supp. III 1997).

[97] 458 U.S. 718 (1982).

[98] *Id.* at 721.

[99] *Id.* at 724 n.8.

the school's stated objective of compensating for the past discrimination of women.[100] The Court stated that women had not been discriminated against in the field of nursing, which was the relevant subject of comparison.[101] The *Hogan* case reflects a strengthened intermediate scrutiny standard compared with what originally had been established in *Craig v. Boren*. Justice O'Connor stated that to pass constitutional muster, a classification based on gender must have an "exceedingly persuasive justification."[102] This greater level of scrutiny proved fatal for the university's all-female nursing program.

The U.S. Supreme Court further defined constitutional standards related to sex-based admissions policies in educational institutions in 1996. In *United States v. Virginia*,[103] the United States sued the State of Virginia for operating the Virginia Military Institute (VMI) as a single-sex public institution of higher learning in violation of the Equal Protection Clause of the U.S. Constitution. The Supreme Court found Virginia's operation of the all-male military academy did indeed violate the Equal Protection Clause.[104] Moreover, the Court spoke definitively on the use of the intermediate scrutiny test for sex-based classifications. In invalidating the policy, the Court relied on the strengthened intermediate scrutiny test it had enunciated in *Hogan*,[105] requiring an "exceedingly persuasive justification" for the admissions policy.[106] In addition, on the remedial issue of creating a comparable facility for women, the Court stated such a remedy will not be appropriate to satisfy the requirements of the Equal Protection Clause where the military school for women, the Virginia Women's Institute for Leadership (VWIL), created by the State of Virginia in an attempt to cure the constitutional violation, is "fairly appraised as a 'pale shadow' of VMI in terms of the range of curricular choices and faculty stature, funding, prestige, alumni support and influence."[107] Under these circumstances, the Court held, "Virginia has not shown substantial equality in the separate educational opportunities the State supports at VWIL and VMI."[108] Nonetheless, the Court noted in reference to single-sex schools that "[s]ex classifications may be used to . . . advance full development of the talent and capacities of our Nation's people."[109]

Hogan and the VMI case illustrate the skepticism with which the Supreme Court views the justifications used by postsecondary institutions for maintaining single-sex admissions policies. The decisions indicate that even when other school choices are available to a student, such as the other state nursing schools in *Hogan* (which were farther away than the Mississippi University for Women), and the Virginia Women's Institute for Leadership (which was of a different character than VMI), a school's single-sex policy may still be unconstitutional.

Single-Sex Schools at the Elementary and Secondary Levels. *Separate-but-Equal Schools:* The Supreme Court upheld the constitutionality of sex-segregated schools at the elementary and secondary levels in *Vorchheimer v. School District of Philadelphia*.[110] However, the continuing validity of that decision is somewhat suspect because the ruling was not held by a majority of the Court, and was not accompanied by a written opinion. Nonetheless, the decision was cited in *Hogan*, with an implication that the Court considered the issue of "separate-but-equal" secondary schools settled by *Vorchheimer*.[111]

---

[100] *Id.* at 730.

[101] *Id.* at 729.

[102] *Id.* at 724 (quoting Kirchberg v. Feenstra, 450 U.S. 455, 461 (1981)).

[103] 518 U.S. 515 (1996).

[104] *See id.* at 2276–2282.

[105] 458 U.S. at 724.

[106] *Id.* at 2274 (quoting Mississippi Univ. for Women v. Hogan, 458 U.S. 718, 724 (1982)).

[107] *Id.* at 2285.

[108] *Id.* at 2286.

[109] *Id.* at 2276. Here the Court noted: "Several *amici* have urged that diversity in educational opportunities is an altogether appropriate governmental pursuit and that single-sex schools can contribute importantly to such diversity. Indeed, it is the mission of some single sex schools 'to dissipate, rather than perpetuate, traditional gender classifications.' " (citing the "Brief for Twenty-Six Private Women's Colleges") *id.*, n.7. The Court further stated, "We do not question the State's prerogative evenhandedly to support diverse educational opportunities. We address specifically and only an educational opportunity . . . available only at Virginia's premier military institute, the State's sole single-sex public university or college." *Id.*

[110] *See* Vorchheimer v. School Dist. of Philadelphia, 532 F.2d 880 (3rd Cir. 1975), *aff'd by an equally divided court*, 430 U.S. 703 (1977).

[111] Mississippi University for Women v. Hogan, 458 U.S. 718, 720 n.1 (1982).

In *Vorchheimer*, the Third Circuit found that maintaining boys-only and girls-only academic high schools did not violate the Equal Protection Clause of the Constitution.[112] The court stated:

> The record does contain sufficient evidence to establish that a legitimate educational policy may be served by utilizing single-sex high schools. The primary aim of any school system must be to furnish an education of as high a quality as is feasible. Measures which would allow innovation in methods and techniques to achieve that goal have a high degree of relevance.[113]

The court further stated:

> We need not decide whether this case requires application of the rational or substantial relationship tests because, using either, the result is the same. We conclude that the regulations establishing admission requirements to Central and Girls High School based on gender classification do not offend the Equal Protection Clause of the United States Constitution.[114]

The court therefore upheld the practice of single-sex schooling in public elementary and secondary education under the Equal Protection Clause. In holding the school district's policy did not violate the clause, the court questioned:

> Do the Constitution and laws of the United States require that every public school, in every public school system in the Nation, be coeducational? Stated another way, do our Constitution and laws forbid the maintenance by a public school board, in a system otherwise coeducational, of a limited number of single-sex high schools in which enrollment is voluntary and the educational opportunities offered to girls and boys are essentially equal? This appeal presents those questions and, after careful consideration, we answer negatively. Accordingly, we vacate the district court's judgment which held that the school board policy was impermissible.[115]

The *Vorchheimer* court conducted part of its discrimination analysis by comparing facilities. The court reasoned if the boys' schools and the girls' schools were providing essentially equal, or comparable facilities, then there was no discrimination present. The court found that the two all-male and all-female academic facilities were "*comparable*, with the exception of those in the scientific field where Central's are superior."[116] This finding remains troubling because it suggests a school district can achieve nondiscrimination, equal educational opportunity, and equal participation for girls in advanced mathematics and science education without having to compare the quality of the advanced mathematics and science education between the two sex-segregated programs. In effect, the court failed to consider whether disparity in the science curricula and facilities created a Title IX violation for the female students with the inferior program, or a violation of the Equal Protection Clause of the U.S. Constitution.[117]

Nonetheless, the Supreme Court's judgment affirming the Third Circuit in *Vorchheimer* appears to support the legality of single-sex public schools, as long as members of each sex have the choice of attending single-sex or coeducational schools, and as long as the facilities are equal. This interpretation of equal protection appears consistent with Title IX's position on single-sex education at the elementary and secondary levels as reflected in the implementing regulations.[118]

School Districts that Provide Single-Sex Schools for One Sex but Not the Other: Where a school district provides a single-sex option for one sex but not for the other, both equal protection and Title IX may be violated. In *Garrett v. Board of Education*[119] the Detroit School District sought to establish three male academies in 1991 in response to the high homicide, unemployment, and dropout rates of African American boys. The board offered no schools for girls comparable to the male-only academies. Applying the standard of intermediate scrutiny used in *Mississippi University for Women v. Hogan*,[120] the court found both the U.S. Constitution and the Michigan Constitution prohibit the exclusion of an individual from a publicly funded school

---

[112] 532 F.2d at 884–885.

[113] *Id.* at 887–88.

[114] *Id.* at 888.

[115] *Id.* at 880, 881.

[116] *Id.* at 882.

[117] *See* "Inner-City Single-Sex Schools: Educational Reform or Invidious Discrimination?" *Harvard Law Review*, vol. 105 (1992), pp. 1741–48.

[118] *See* 34 C.F.R. §106.35 (1998).

[119] 775 F. Supp. 1004 (E.D. Mich. 1991).

[120] 458 U.S. at 718.

because of his or her gender unless the school district can show the gender-based classification serves important governmental objectives and the discriminatory means employed are substantially related to achieving those objectives. The court stated the evidence the board offered did not demonstrate that excluding girls is substantially related to the achievement of the board's objectives. Although the school district of Detroit created the all-male academies to address the specific problems affecting African American boys, the court held that the board could not show that girls had to be excluded in order to achieve the objective. In other words, the purpose for which the academies were developed did not override the interests of equal educational opportunities for girls.

While Title IX exempts elementary and secondary schools from its mandate on equal opportunity in admissions, it is possible to challenge a school district's decision to provide single-sex schools using a comparable benefits and services analysis.[121] However, this analysis was not performed in *Garrett*,[122] so it is unclear to what extent it may be used in arguing a Title IX violation exists in this context.

Fully Sex-Segregated School Districts: Where an entire school district is sex segregated, a federal court has held that equal protection and the EEOA are violated.[123] In *United States v. Hinds County School Board*,[124] the Fifth Circuit invalidated a sex-segregated student assignment plan adopted as part of a desegregation decree.[125] The *Hinds* court distinguished *Vorchheimer* by finding:

> [A] large city school system [as in the *Vorchheimer* case] . . . maintained two, *voluntary*, sexually segregated high schools . . . In [this] county, on the other hand, all students in the system, are *assigned* to sexually segregated schools at every level, from entry through graduation. Such a system can neither pass muster under *Vorchheimer's* analysis or our own.[126]

It appears the courts in *Vorchheimer* and *Hinds* reached differing holdings as to the legality of single-sex schools, but based their decisions on similar key factors. Single-sex schools were upheld where there were only a few single-sex schools (such as the case in *Vorchheimer*) in comparison to the school district's whole public elementary and secondary education system (such as in *Hinds*). In the former system the choices of parents or students were not limited. Finally, these courts conducted a careful inquiry to determine whether or not comparable facilities existed where a school district had developed a single-sex educational program.

OCR's Implementation, Compliance, and Enforcement Efforts

Title IX Regulations

OCR has a clear legal official position on single-sex education as stated in its regulations: single-sex classes/courses generally are prohibited[127] and single-sex elementary/secondary schools may be permitted if comparable services, facilities, and courses are provided for the other sex at a school with the same admissions criteria.[128] The regulations prohibit state and local educational agencies that are recipients of federal funding from excluding any person on the basis of sex from admission to:

---

[121] *See* Garrett, 775 F. Supp. at 1008 (citing 34 C.F.R. 106.31(b)(2) (1998)).

[122] The court referred to the plaintiffs' argument that was based on the benefits/services analysis, but did not actually perform it. 775 F. Supp. at 1009.

[123] Section 1705 provides that the assignment of students to the neighborhood school which provides the "appropriate grade level and type of education" is permissible under the act "unless such assignment is for the purpose of segregating students on the basis of . . . sex. . . ." 20 U.S.C. § 1705 (1994). Thus the court found that Section 1705 expressly prohibited the county's sex-segregated student assignment plan. 560 F.2d 619, 624 (5th Cir. 1977).

[124] 560 F.2d 619.

[125] *Id.* at 624–25.

[126] *Id.* at 624 n.7 (emphasis added).

[127] 34 C.F.R. § 106.34 (1998). Section 106.34 states: "A recipient shall not provide any course or otherwise carry out any of its education program or activity separately on the basis of sex, or require or refuse participation therein by any of its students on such basis, including health, physical education, industrial, business, vocational, technical, home economics, music, and adult education courses."

[128] 34 C.F.R. § 106.35 (1998). Section 106.35 states: "A recipient which is a local educational agency shall not, on the basis of sex, exclude any person from admission to: (a) Any institution of vocational education operated by such recipient, or (b) Any other school or educational unit operated by such recipient, unless such recipient otherwise makes available to such person, pursuant to the same policies and criteria of admission, courses, services, and facilities comparable to each course, service, and facility offered in or through such schools."

Any other school or educational unit operated by such recipient, *unless* such recipient otherwise makes available to such person, pursuant to the same policies and criteria of admission, courses, services, and facilities comparable to each course, service, and facility offered in or through such schools.[129]

Thus, the Title IX regulations permit single-sex schools if the schools use the same admissions policies and criteria and assure separate but comparable facilities, courses, and services for both sexes.[130]

In addressing access to course offerings, the regulations state that "a recipient shall not provide any course or otherwise carry out any of its education program or activity separately on the basis of sex, or require or refuse participation therein by any of its students on such basis, including health, physical education, industrial, business, vocational, technical, home economics, music, and adult education courses."[131] In other words, single-sex classes are prohibited by OCR's Title IX regulations with certain exceptions. This provision does not prohibit coeducational schools' separation of students by sex within physical education classes involving bodily contact, human sexuality classes in elementary and secondary schools, and choir classes.[132] Separate classes may also be provided for pregnant students, but must be comparable and voluntary.[133] Another exemption to this provision is based on the affirmative action provision of the regulation.[134] The regulations state that in the absence of a finding of discrimination on the basis of sex in an educational program or activity, a recipient "may take affirmative action to overcome the effects of conditions which resulted in limited participation therein by persons of a particular sex."[135]

In cases involving single-sex schools relying on an affirmative action program, the investigative analysis must proceed along established legal precedent for state action that might impinge on the fundamental right of equal protection of the laws.[136] For example, regarding affirmative action programs, OCR's investigators will engage in an intermediate scrutiny type of analysis to determine whether the classifications that result in single-sex schools are related directly to the reasons for the institution of such schools. This means that: (1) beneficiaries of the single-sex schools must have had limited opportunities to participate in a school's programs or activities due to their sex, (2) less restrictive or segregative alternatives that may have accomplished the goals of the single-sex schools must have been considered and rejected, and (3) there must be evidence that comparable sex-neutral means could not be reasonably expected to produce the results sought through the single-sex schools.[137]

Policy Guidance

OCR has developed a resource guide for internal use on the implications of sex-based discrimination as it relates to Title IX compliance. As part of OCR's resource guidance collection, the document provides guidance for cases alleging sex discrimination for such issues as separate schools and courses, transportation, and special purpose schools.[138] The guidance document provides statutory and regulatory authorities for Title IX compliance. In addition, the document provides selected references on single-sex issues, including "Single-Sex Schooling: Perspectives from Practice and Research," developed by the Office of Educational Research and Improvement (OERI). OCR also provides a summary of case law and case resolution letters on single-sex issues.[139]

OCR recognizes in the resource guidance document that there are no policy documents on single-sex education.[140] However, OCR has not made attempts to produce any policy guidance for educators and school officials as to their responsibilities and restrictions with regard to single-sex education. Although the resource guidance mentioned above references the single-sex report issued by the Office of Educational Re-

---

[129] 34 C.F.R. § 106.35(b) (1998) (emphasis added).

[130] 34 C.F.R. § 106.35(a), (b) (1998).

[131] 34 C.F.R. § 106.34 (1998).

[132] 34 C.F.R. § 106.34(c), (e), (f) (1998).

[133] 34 C.F.R. § 106.40(b)(1) (1998).

[134] 34 C.F.R. § 106.3 (1998).

[135] 34 C.F.R. § 106.3(b) (1998).

[136] U.S. CONST. amend. XIV.

[137] GAO, *Issues Involving Single-Gender Schools and Programs*, pp. 22–23.

[138] U.S. Department of Education, Office for Civil Rights, "Section 933—Title IX, Separate Schools, Classes, Transportation, Special Purpose Schools" (resource guide collection).

[139] Ibid.

[140] Ibid.

search and Improvement, OCR has made no attempts to address the recommendations made in that report.

In 1992, OERI brought together a group of researchers and practitioners to explore issues related to single-sex education. Among the recommendations of conference participants was that DOEd address two paramount problems with Title IX regulations. The first is that there is considerable confusion about which forms, if any, of single-sex schooling are permissible. The participants suggested that although the regulations allow school districts to establish single-sex schools when both sexes are accorded the opportunity to attend a single-sex school of comparable quality, those programs that fall within legal bounds must be clarified for school officials.[141] Similarly, it was stated that few school officials understand the regulatory provisions pertaining to single-sex classrooms, such as in the case of physical education classes. There was a common feeling that as the regulations are currently stated, few single-sex classes would meet federal requirements. Conference participants asked the Department of Education to "publish and disseminate written clarifications of these requirements, which should delineate, as clearly as possible, when schools and classrooms employing single-sex policies are within the Title IX requirements."[142]

Another criticism the conference participants put forth is that the Title IX regulations lack flexibility, and they may actually restrict the school structures that could potentially accomplish the original goals of Title IX. They argued:

> Requirements regulating the establishment of single-sex schools specify that districts institute two schools (a boys' and girls' school), even if there is unequal demand, or, as in the case of nonminority boys, even if a compelling research base for doing so does not yet exist. At the level of the classroom, the regulations provide no flexibility for schools to explore the effectiveness of single-sex classrooms as an alternative to current practice.[143]

They called upon federal authorities to relax policies formulated in "a different era and on the basis of an unverified assumption that single-sex environments are almost always harmful to the educational development of girls."[144] More than 7 years after the conference, the Department of Education has not yet produced guidance for school administrators, teachers, or other education officials, despite renewed interest in single-sex education.

Cases on Single-Sex Education

OCR has had relatively few complaints or requests for guidance on single-sex schools or single-sex classrooms. Typical requests for guidance and complaints brought against school districts involving single-sex classrooms include single-sex physical education classes, single-sex mathematics and science classes for girls, segregated technology classes, and single-sex mentoring clubs. Complaints of this nature have been resolved in a variety of ways, but are usually remedied relatively easily by opening admissions policies to all students, regardless of gender, and altering administrative processes for student recruitment.[145] Although the result may not be coeducational classrooms or schools based on the fact that students of the minority sex (in these cases males) may not choose to apply, OCR has generally found that as long as all students have the option of enrolling, there is no Title IX violation.

Single-Sex Classes. Complaints against single-sex physical education classes are among the most common. OCR states that schools segregate the sexes, unaware that in most cases this is not permissible under Title IX regulation, although the regulation does permit portions of classes to be separated by gender when students are playing contact sports.[146] These complaints generally are resolved by changing the physical education classes to coeducational ones. Merely adding coeducational classes while maintaining single-sex classes does not remedy the violation.[147] Schools must discontinue segregating their physical education classes on the basis of sex to comply with Title IX regulation.

OCR advised a California school district on Title IX compliance in the context of a single-sex

---

[141] DOEd, *Single-Sex Schooling: Perspectives from Practice and Research*, p. 76.

[142] Ibid.

[143] Ibid.

[144] Ibid.

[145] Ibid., pp. 9–10.

[146] Ibid.

[147] Ibid.

educational program. The case of the Ventura Unified School District involved complainants who alleged the school district violated Title IX by offering a mathematics and science program for girls only.[148] The school district satisfied OCR's concerns by informing them none of the mathematics and science courses offered to secondary students was designed specifically to exclude boys. The school district assured OCR both boys and girls were allowed to participate in the program. The school district did, however, acknowledge there were "six sections of mathematics courses at the two district high schools that predominantly enrolled girls," which may have invoked statistical significance concerns on the part of OCR.[149] The school district explained those particular sections were the result of a "district pilot program to see if mathematics sections composed primarily of girls who are 'math phobic,' or other reluctant mathematics students, could increase the girls' enrollment in higher level math courses."[150] The school district conceded some boys also fit this profile.[151] The school district issued a memorandum to the principals of the two district high schools, directing them to "focus the counseling, registration, and recruitment of students for the pilot mathematics sections on academic need rather than gender."[152] The memorandum stated that "gender will no longer be mentioned as a requirement or preference for enrolling in these sections of math."[153] Based on this memorandum, OCR determined the district had taken "appropriate action" in response to the complaint, and that there "were no current allegations appropriate for further complaint resolution."[154] The classes were therefore described as providing a supportive environment for students who are doubtful about their ability to succeed in challenging mathematics classes, and all students regardless of gender who fit these categories can be targeted and encouraged to enroll.

The Connecticut Department of Education also sought OCR's guidance on a new introductory technology course to be offered in two formats, an all-female class and a mixed-gender class.[155] After discussion with OCR, the department revised the format so it had a regular class and a second class targeted to female students but accessible to all students regardless of sex. Both classes were to be open to all students, and OCR noted the revised proposal did not appear to raise concerns of discrimination under Title IX.[156]

OCR used a similar approach in Presque Isle, Maine. There, OCR investigated a complaint alleging a school district was violating Title IX by offering a ninth-grade algebra course for girls only.[157] After a review by OCR, the district issued a memorandum for guidance to the faculty and parents of affected students.[158] The memorandum stated the course was open to all students regardless of sex. The memorandum indicated one section of the ninth-grade algebra course would be an elective open to all students and would include discussion about the history of women in mathematics and career opportunities for women in mathematics.[159] The actions taken by the school district satisfied OCR's Title IX requirements.[160]

Single-Sex Schools. OCR has addressed several complaints alleging violations of Title IX in the context of equal access to educational programs. In 1992, OCR investigated complaints in Philadelphia and Baltimore that the school districts maintained single-sex public secondary schools for girls only.[161] As one of the nine magnet high schools in the city, Philadelphia High School for Girls targets students with high academic performance and good attendance for admission. During OCR's investigation, district

---

[148] John E. Palomino, letter to Joseph P. Spirito, superintendent, Ventura Unified School District, Ventura, CA, Mar. 1, 1995 (OCR docket no. 09-95-1092-L) (hereafter cited as Ventura letter of finding). *See also* GAO, *Issues Involving Single-Gender Schools and Programs*, p. 9.

[149] Ventura letter of finding.

[150] Ibid.

[151] Ibid.

[152] Ibid.

[153] Ibid.

[154] Ibid.

[155] GAO, *Issues Involving Single-Gender Schools and Programs*, pp. 9–10.

[156] Ibid.

[157] Robert L. Pierce, program manager, Office for Civil Rights, Region I, U.S. Department of Education, letter to Gehrig Johnson, superintendent, School Administrative District #1, Presque Isle, ME, May 15, 1995.

[158] Ibid.

[159] Ibid.

[160] Ibid.

[161] Ibid., pp. 8–9.

officials stated that all students are encouraged to apply to these magnet schools and are provided with booklets describing the high school programs. OCR found that district officials had no policy of excluding boys from this school, so the district had not violated Title IX.[162]

OCR also investigated another single-sex public secondary school for an alleged violation of Title IX. Baltimore's Western High School draws qualified students from the entire city. To be accepted for admission, students must have a B average and, to remain at the school, they must maintain a C average. During a review of Western's policies and curriculum, OCR found other citywide high schools also offered similar programs to both sexes. District officials stated the booklets the guidance staff distribute have no language indicating that Western is for girls only and applications are evaluated on merit and ranked in order without regard to sex. OCR found that the district did not exclude male students from applying or attending Western and was therefore in compliance with Title IX.[163]

Recently a debate has ensued over the establishment of an all-girls middle school in East Harlem, the Young Women's Leadership School. The school, which first opened its doors in September 1996, has elicited both scrutiny and praise from educators, legal scholars, the media, and civil rights groups. The Young Women's Leadership School (YWLS) was designed to address the needs of middle school girls in the predominantly African American and Hispanic neighborhood of East Harlem who, according to the developers of the program, were suffering disproportionately from poor education and external influences resulting in limited educational opportunities. The public junior high school emphasizes math, science, and leadership skills and is based on the rationale that the students will perform better if there are no boys in the classroom.[164] The school's curriculum and teaching techniques emphasize collaboration, interdisciplinary studies, and project-oriented tasks in an effort to provide a supportive environment in which girls can thrive academically and socially.[165]

While the creation of the school was intended to improve opportunities for girls, it has been criticized for discriminating against boys. Those opposed to the school, including the New York Civil Liberties Union, the New York chapter of the National Organization for Women, and the New York Civil Rights Coalition, who have filed a formal complaint with DOEd/OCR, argue that it violates federal antidiscrimination laws, including the 14th Amendment, Title IX, and the Civil Rights Act of 1964.[166] They look to the Virginia Military Institute case as precedent, interpreting the decision to mean that segregation on the basis of sex is not permissible in federally funded institutions, unless equal provisions are made for both sexes. The complaints filed to the Department of Education state that "separate has never been equal and the goal should be to improve schooling for girls in more realistic coeducational environments."[167]

Supporters of the YWLS, on the other hand, interpret the majority opinion in the VMI case as viewing single-sex schools that are intended to remedy a history of subjugation, such as the YWLS, different from those schools, such as VMI, that continue a pattern of intentional exclusion.[168] The Department of Education's Office for Civil Rights, however, appears to disagree with this interpretation. In September 1997, OCR notified the New York City School Board that the YWLS appeared to violate federal civil rights laws.[169] Although OCR has not yet issued an official finding of violation with regard to Title IX, it suggested in a preliminary finding that the New York School Board should rethink the structure of the program, either to include boys or to create a comparable facility for males.[170]

---

[162] Ibid.

[163] Ibid.

[164] Elizabeth M. Schneider, "A Postscript on VMI," *The American University Journal of Gender and the Law*, fall 1997, pp. 59–64.

[165] Amy B. Bellman, "The Young Women's Leadership School: Single-Sex Public Education After VMI," *Wisconsin Law Review*, 1997, pp. 827–64.

[166] Jason M. Bernheimer, "Single-Sex Public Education: Separate but Equal is not Equal at the Young Women's Leadership School in New York City," *New York Law School Journal of Human Rights*, vol. 14 (1997), pp. 339–73.

[167] Koman, "Urban, Single-Sex, Public Secondary Schools," p. 510, quoting Michael Meyers of the New York Civil Rights Coalition.

[168] Schneider, "A Postscript on VMI," p. 63.

[169] Koman, "Urban, Single-Sex, Public Secondary Schools," p. 510.

[170] Bernheimer, "Single-Sex Public Education," p. 364.

The chancellor of New York Schools has refused to do either, stating that to admit boys would be to negate the fundamental purpose of the YWLS and that the school opened "in response to the educational needs of young people."[171] It has been argued by New York School Board officials that there is already a comparable facility available to boys in the neighboring coeducational pubic school. Educators at the YWLS have trained educators at the coeducational school, particularly with regard to some of the unique techniques that have been used at the YWLS, in the hopes that boys will also benefit.[172]

The case of the Young Women's Leadership School is still under investigation.[173] However, the ultimate finding of this case in particular has the potential to determine the future of single-sex education at the elementary and secondary levels, in much the same way that the VMI decision challenged the status quo of single-sex postsecondary education.

[171] Ibid., p. 341; *see* Koman, "Urban, Single-Sex, Public Secondary Schools," p. 510.

[172] Bernheimer, "Single-Sex Public Education."

[173] The Commission requested information on the status of the Young Women's Leadership School, however, the Department of Education stated that it is OCR policy not to discuss pending cases, and it could therefore not disclose information about the investigation. Brenda L. Wolff, special assistant for equity, U.S. Department of Education, letter to Frederick D. Isler, assistant staff director, Office of Civil Rights Evaluation, U.S. Commission on Civil Rights, Sept. 3, 1999 (re: request for information).

CHAPTER 8

Findings and Recommendations

General Summary

Over the past 30 years, girls and women have made progress in access to and participation and achievement in advanced mathematics and science courses. Many women have gone on to major in mathematics- and science-related fields in college and to pursue nontraditional careers in technical and scientific areas. Nevertheless, evidence exists indicating that there are lingering barriers impeding girls and women from equal educational opportunities in advanced mathematics, science, and technology. Disparities in participation rates in the highest level math and science classes, exposure to and use of technology, scores on standardized tests in math and science, and the pursuit of science and technological careers all suggest that women do not enjoy the same educational opportunities as men.

Title IX of the Education Amendments of 1972 was an early attempt to remedy these disparities. It was enacted at a time when girls and women experienced considerable overt discrimination in advanced mathematics and science education. At that time, girls lagged far behind boys in their participation and achievement in advanced mathematics and science courses; few girls chose college majors in mathematics- and science-related fields; and few women worked in nontraditional, scientific, and technical jobs. Title IX and its implementing regulations have offered a means for women to gain equal access to classes, activities, and educational services.

This report acknowledges the relationship between educational practices and civil rights. To ensure fully that girls in public schools receive a mathematics and science education that is nondiscriminatory and that affords equal educational opportunity, it is important to understand how educational practices influence opportunities. Further, to create effective civil rights regulations and policies it is important to incorporate sound educational principles into guidelines for the provision of nondiscriminatory education.

This report evaluates the Title IX compliance and enforcement program of the U.S. Department of Education's (DOEd) Office for Civil Rights (OCR) to assess OCR's efforts to ensure nondiscrimination for girls in advanced mathematics, science, and technology and to offer recommendations for improvement. The report considers the extent to which OCR incorporates five important equal educational opportunity principles into its Title IX compliance and enforcement activities related to girls' access to advanced mathematics, science, and technology programs:

1. Structuring educational programs to serve a diverse student population by maintaining a primary objective to place students in regular classes and core academic curricula to the greatest extent possible; grouping students to reflect different abilities in various subjects; and reevaluating and regrouping students periodically to reflect different abilities in various subjects and changes in achievement, performance, and development.
2. Using neutral and nondiscriminatory diagnostic and screening procedures when placing students in educational programs.
3. Providing parental notification and ensuring that institutional programs facilitate and encourage the involvement of parents in their children's education.
4. Evaluating and allocating teachers, facilities, and other resources among educational programs.
5. Eliminating barriers, providing access to all subjects, activities, and career opportunities, and counseling each student to maximize his or her potential.

General Finding: Despite federal efforts to ensure nondiscrimination on the basis of sex in educational programs, disparities between boys and girls in advanced math, science, and technology educational programs remain. While more women are involved in math- and science-related endeavors than ever before, men continue to outnumber women in science and technology educational programs and careers. The Commission's research suggests that although girls and boys begin their educational careers on equal ground in math and science, they find themselves on divergent paths. As students reach high school and college, there are stark gender differences in course-taking patterns and test scores.

The quality of a student's education is affected by a variety of factors: diagnostic and screening procedures, parents, teachers, counselors, resources, ability grouping, and other structural influences interact to shape a student's experiences. To ensure equal opportunity in education for both girls and boys, it is important to ensure that each of these factors is nondiscriminatory and free of bias. Differences in educational outcomes, such as postsecondary school enrollment, choice of college major, careers, and, ultimately, lifelong earnings, may indicate that at some point along the way, some form of discrimination or adverse impact occurred to unfairly limit an individual's opportunities. It is important to determine how and if unfair barriers to participation and discrimination occur and affect achievement, aspirations, self-esteem, socialization, and the desire to learn.

The Office for Civil Rights is responsible for ensuring equal opportunity within educational programs. With this report, the Commission found that OCR has a mixed record in Title IX compliance and enforcement activities relating to women and girls in advanced math and science education. OCR has made a credible effort to ensure that schools do not discriminate against girls in advanced math and science and to encourage schools to adopt educational practices that promote equal opportunity for girls in these subjects. However, the Commission found several areas in which OCR could strengthen its Title IX compliance and enforcement programs.

General Recommendation: While it is obvious that not every student will choose to pursue a course of math or science resulting in a technology-related career, it is important that OCR and school districts ensure that barriers do not exist which limit a student's option of doing so. As such, OCR must be proactive in its enforcement of Title IX, particularly in regard to participation in advanced math, science, and technology education. To do this, OCR must work with other parts of the Department of Education, such as the Office for Elementary and Secondary Education (OESE) and the Women's Educational Equity Act (WEEA) program office, to develop innovative programs to review schools for Title IX compliance and to provide technical assistance to schools to ensure compliance.

Further, women and girls need greater encouragement to pursue math- and science-related educational programs. As such, DOEd should collaborate with the Women's Bureau of the U.S. Department of Labor, the National Science Foundation (NSF), and other agencies and organizations that focus on women's labor force issues. With the input of these agencies and organizations, DOEd should develop a series of technical assistance documents that describe math and science careers and how to get into those fields. For example, DOEd could develop brochures that offer information similar to that contained in the Bureau of Labor Statistics' *Occupational Outlook Handbook*. This information should be supplemented with stories of successful men and women in these occupations so that students have role models to follow. In addition, career brochures should offer practical information on how technological fields are related to everyday life, and how to gain entry into those fields. For example, the brochures could describe how math and science education is related to medical and veterinary careers, how computers are used to run everyday things like cars and trucks, and how math and science knowledge benefits farmers and soil scientists.

In addition, an interagency task force should be established that will identify how federal agencies can broaden the educational and occupational choices of students and encourage students to pursue technical fields. This task force should create a nationwide speaker's bureau that will provide speakers to make presentations at local elementary and secondary schools about career choices. Both girls and boys should be encouraged to pursue "nontraditional" occupations, such as math and science for girls and the arts

and writing for boys. The interagency task force, by teaching students that they have a variety of occupational choices, can encourage students to stay in school and achieve their dreams. The task force also should provide information to students to help them understand financing options available to them for postsecondary education.

Chapter 2. Background

Equal opportunity in education is a relatively recent phenomenon. History shows us that women received inferior educational instruction, if they were not altogether banned from education, in the early years of our nation's history. Although opportunities increased after World War II and further after the civil rights movement and the women's rights movement, equal educational opportunity for women was not made into law until 1972, with Title IX of the Education Amendments. The Women's Educational Equity Act of 1974 further underscored the need to provide increased opportunities for women in educational settings.

Nonetheless, barriers to equal opportunity for women remain, and there are several areas in which women and girls receive different treatment than men and boys. In particular, women are not receiving equivalent instruction and opportunities in advanced areas of math, science, and technology. Some of the factors inhibiting girls' and women's participation in these areas are overt forms of discrimination and sexual harassment. However, societal factors, including gender-role stereotypes and socialization, contribute to girls' diminished self-esteem and negative attitudes toward math, science, and technology. While socialization and attitudes are not explicitly civil rights issues, student-teacher interactions, classroom activities, and counseling services that lead to or exacerbate individual feelings of inability in or avoidance of math- and science-related areas could, if found to be different on the basis of sex, result in a disparate impact or Title IX violation.

These barriers result in gaps in participation and achievement in advanced mathematics and science education. Gender differences in math, science, and technology are minimal or nonexistent at the elementary school level, but appear to grow as students progress through high school. Although this gap has narrowed, girls still do not enroll in some advanced classes, particularly physics and computer science, at the same rate as boys. These differences at the secondary level result in differences in higher education and career development. For example, women are underrepresented in computer science, engineering, geoscience, mathematics, and physical science fields.

One area in particular where girls and women lag behind in both education and career development is in computer science and technology. In elementary and secondary education, girls are not as likely as boys to participate in activities that promote the use of technology and computers, and are less likely to use computers as they grow older. Boys outnumber girls in computer science and computer design classes, and this gap widens from junior high to high school. This is compounded by the fact that the computer software industry caters to males, reinforcing girls' reluctance to pursue interests in this area.

In summary, extensive research indicates that girls are treated differently than boys in school, particularly in mathematics and science subjects; that girls receive less teacher attention; that textbooks and other educational materials are gender biased; and that the result is that girls have little self-confidence in their abilities in mathematics, science, and technology and are less likely than boys to plan college majors or careers in these fields. This research—along with the growing importance of advanced mathematics and science education for access to good jobs in an evolving economy—underscores the importance of ensuring, through Title IX compliance and enforcement activities, that schools do not discriminate against girls in advanced mathematics, science, and technology.

Finding: There has been a tradition of discrimination against girls and women in education. Although much has changed, particularly since the enactment of Title IX, sexual harassment and gender stereotyping continue to impede women's educational progress. Other barriers to equal educational opportunity in advanced math, science, and technology education include different participation and achievement in these courses, gender-role socialization, and weak encouragement from counselors and teachers, all of which affect students' attitudes and confidence concerning math and science courses.[1]

---

[1] *See generally* chap. 2.

Recommendation: Educators, researchers, and civil rights organizations should conduct analyses of factors such as sexual harassment, gender stereotyping, and attitudes, to determine the extent to which such factors affect access to and participation in advanced math, science, and technology courses. In addition, OCR should work with such groups to develop (or update existing) technical assistance materials on each of these factors so that parents, teachers, counselors, and school administrators are aware of the effect they can have on students' interests and goals.

In addition, OCR needs to incorporate more detailed analyses into its investigations and compliance reviews of underrepresentation of girls in math and science. It is crucial to determine not only the proportions of girls to boys in advanced math and science classes, but, for example, the extent of exposure to computers or other resources received by girls compared with boys. In addition, OCR should look at achievement scores to determine if there are statistically significant differences between boys and girls in certain states, schools, and classrooms. Differences in achievement can indicate that girls are not learning certain concepts, and it is important to determine if this lack of knowledge is the result of some form of discrimination or unequal treatment.

Further, the Department of Education should conduct a nationwide survey of elementary and high school students to determine the extent to which the barriers identified by the Commission affect students' attitudes, achievement, and participation in school, particularly in relation to math and science education. More detailed data should be collected on students' experiences within math, science, and technology classes and how students perceive those experiences. For example, questions to be asked could include: Do you feel one sex is favored over another in classroom discussions? For what reasons did you take (or not take) a calculus class? Have you ever felt harassed because of your race or sex in your science (math, English, computer, etc.) class?

Finally, OCR should develop a great deal more technical assistance material addressing underrepresentation of women in advanced math, science, and technology education, more outreach and education, and more workshops and conferences. It is essential for OCR to work with schools and with school communities, in particular with parents, so that girls can develop their potentials in advanced mathematics and science and begin moving into college majors and careers in mathematics and science fields in much greater numbers than they are now.

Finding: Despite some gains, women remain underrepresented in many advanced math, science, and technology fields and receive fewer science and engineering degrees. Stereotypes about gender roles persist, affecting the experiences girls and women have in the educational setting. Early on, both girls and boys aspire to math- and science-related careers. Oftentimes, boys are encouraged in those areas, while girls are directed toward more "feminine" careers. Further, boys are often socialized to be aggressive and to think about abstract mathematical and science concepts, while girls are socialized to be passive, caring, and expressive. Parents, teachers, counselors, peers, the media, and other people and institutions aid in the socialization of children, which often results in socialization into stereotypical gender roles and limits the career options of both males and females. Over time, these attitudes can be translated into discriminatory treatment. Historical discrimination in education has been compounded by discrimination in the workplace, resulting in unequal wages and limited career opportunities.[2]

Recommendation: Because these persistent stereotypes can have repercussions for the labor force and the competitiveness of the United States as a nation, the Department of Education, in conjunction with Congress, should ardently fight to eliminate the discrimination that hinders women's and girls' educational opportunities. In conjunction with the U.S. Department of Labor, OCR and program offices within DOEd, such as the Women's Educational Equity Act office and the Office of Elementary and Secondary Education, should develop programs aimed at removing gender stereotypes attached to certain career fields. Such programs should include having female and male professionals introduce students to fields to which they have had little exposure. Schools should encourage interaction with mentors and role models (particularly women who have established careers in science and technology fields) to eliminate sex-role

[2] *See* chap. 2, pp. 14–26.

stereotyping and should actively seek to enhance interest in science and math (for boys and girls alike) through science camps, after-school science clubs, and academic enhancement programs.

Finding: Several studies have examined girls' and boys' attitudes toward and experiences in math and science. Although evidence from these studies is mixed, the studies generally indicate both boys and girls have positive attitudes toward mathematics and science during elementary school. However, as they progress through school, a gender gap in interest, self-confidence, and aspirations in mathematics and science seems to emerge, with girls generally expressing less interest in mathematics and science, less confidence in their abilities in these fields, and less interest in pursuing advanced high school or college majors in these subjects. For example, one author noted that even though girls receive higher grades in math and science and have similar achievement scores in several areas, they *think* they are not performing as well. Experiences in class, teachers' deference to boys, and counselors' discouragement add to adolescent insecurities.

Further, research has suggested that both middle school and high school girls, at least from their own perspectives, may be more likely than their male counterparts to be encouraged to pursue advanced mathematics and science courses by parents, guardians, and other adults outside of school, as well as by teachers, guidance counselors, and other school personnel. However, other researchers have argued that women in science- and math-related graduate programs and careers receive little support from colleagues, professors, mentors, and peers.[3]

Recommendation: In much the same way that girls have been encouraged in athletics, school districts must encourage girls to participate in advanced math, science, and technology courses. OCR should work with the WEEA office to create technical assistance programs and documents to address the need for gender-equitable and gender-neutral experiences in these fields. This technical assistance should be provided to educators to assist them in raising the interest of all students in math and science, allaying fears about math and science courses, demonstrating the everyday applicability of math and science concepts, and further eliminating stereotypes about women in math and science.

Researchers and educators must assess what occurs between early education and secondary education that causes the dramatic decline in girls' interest and performance in advanced math, science, and technology. Once those factors are determined, they should work with teachers and school administrators to develop educational programs that sustain learning throughout students' educational careers.

Finding: Certainly not all students learn in the same way, however researchers have suggested that there are gender differences in learning styles. Thus, if teaching styles, particularly in math and science courses, are tailored to boys' ways of learning and understanding, girls may be adversely affected. Teaching styles that employ a learning style other than a student's preferred way of learning cause the learning experience to be less enjoyable and less successful for that student.[4]

Recommendation: OCR and other organizations and researchers evaluating underrepresentation of women and girls in advanced math, science, and technology must consider several factors, including student-teacher interactions and teaching styles. OCR, in conjunction with the educational community, should develop technical assistance programs and guidance on teaching styles and the effectiveness of certain teaching styles in teaching math, science, and technology to girls and boys. This information should be made available to teachers and educators throughout the country. In particular, when conducting compliance reviews, OCR should provide this material to teachers and take the time to discuss its usefulness and application to math, science, and technology classes. Subsequently, OCR should conduct postreview followups to determine if the materials have been used by teachers and schools and to what extent they have been effective. Additional followup reviews should be done to see if changes in teaching style have had an effect on student participation and interest in math, science, and technology courses.

---

[3] *See* chap. 2, pp. 14–26.

[4] *See* chap. 2, pp. 23–24.

Finding: Sexual harassment, which also occurs in the school setting in the form of hostility from male peers or faculty, disproportionately affects girls and women, has a negative effect on students' educational experiences, and denies them equal educational opportunity. Educational researchers have suggested that sexual harassment discourages women from entering math, science, and technology fields such as engineering. OCR acknowledges that sexual harassment can affect one's achievement and self-esteem, and has designated sexual harassment as one of its priority areas. However, OCR has not specifically looked at sexual harassment within certain fields, such as advanced math, science, and technology.[5]

Recommendation: In conducting compliance reviews and complaint investigations concerning sexual harassment, OCR should look at the contexts in which alleged incidents of sexual harassment occur (e.g., in math/science classes, outside of the classroom). At the elementary and secondary levels, the Department of Education should work with teachers and school administrators to learn how to identify those behaviors, on either the part of male students or faculty, that might be psychologically or emotionally damaging to female students, and that might discourage them from reaching their potential in math, science, and technology courses. Counselors should work with boys to help them understand how their behavior might affect girls. This will help ward off potential sexual harassment before it occurs.

OCR should target math, science, and technology programs at the postsecondary level to determine if sexual harassment is occurring in these fields. For example, OCR should conduct a compliance review of equal opportunity in medical education programs. OCR should determine if men and women have similar opportunities to enter research programs, if funding is equivalent for both sexes, and if women have the same opportunities as men for internships and apprenticeships in "high-profile" areas and/or with the "top" educators and experts in their fields. OCR should also develop an enforcement program for determining if women's research projects and proposals in medical research education are considered in the same proportions as men's projects and proposals. In other words, OCR should conduct compliance reviews to determine if women are provided equal opportunities to pursue medical education and research within medical schools in the same way men are provided opportunities. Similar reviews should be conducted for engineering, computer science, and other educational programs at all levels of education.

Finding: Recent research suggests that girls' experiences with computer technology differ greatly from boys' experiences. Girls are less likely than boys to learn about the technology involved with computers and are more likely to use computers for data entry, word processing, and practical purposes. In the classroom, boys are more likely to "take over" during computer-related exercises, while girls concentrate on group dynamics. In elementary and secondary schools, girls are not as likely as boys to participate in activities that promote the use of technology and computers, and are less likely to use computers as they grow older. Those with limited experience with technology, particularly information technologies, are at a disadvantage when they reach the undergraduate level and beyond.

While gender differences in mathematics and science participation and achievement have narrowed, the gender gap in technology continues to be significant. Software designed and marketed to target boys, boys' more extensive use of computers in and out of school, the disproportionate number of male candidates for higher education degrees in technology, and the notable difference in the number of males and females in technology-related fields perpetuate the idea that technology is exclusively for males.[6]

Recommendation: OCR should conduct compliance reviews to determine the extent to which girls and boys have different access to computer resources within schools and within classrooms. OCR should measure the extent to which girls are provided equal computing time, facilities, and resources related to computer and technology education. In addition, the WEEA program office should work with civil rights organizations and software companies to provide technical assistance on the importance of non-

[5] *See* chap. 2, pp. 25–26.

[6] *See* chap. 2, pp. 26–30.

stereotypical and gender-neutral educational software programs.

Education and technology experts suggest several ways to encourage girls to get involved in technology, which the Commission supports. First, teachers should be trained on becoming sensitive to integrating gender-equitable computer use in classroom activities and designing lessons that highlight the contributions of women in math, science, and technology. Second, teachers should expose students to female mentors and role models in technology. Third, they should provide girls with opportunities for play and open-ended exploration on the computer and encourage parents to be supportive of girls' computer use and interest in technology. Finally, teachers should encourage girls' ownership of computers, which should lead to an increase in girls' use of computers at all levels.

Finding: Title IX ensures nondiscrimination in educational programs for both boys and girls. Thus, it is important to ensure that they both have equal educational opportunities. For example, while girls are underrepresented in math and science courses and achievement, they have higher achievement and participation in subject areas such as English, reading, and writing. Research suggests that girls are encouraged to read and write, while boys are encouraged to study math and science.[7]

Recommendation: While a students' preferences and interests should be respected, it is important to ensure that both boys and girls are provided equal opportunities and encouragement to pursue educational opportunities. Therefore, the Department of Education, under the direction of OCR, should develop technical assistance materials related to gender equity. Such materials should include findings and recommendations of educational researchers in regard to programs and strategies aimed at gender-inclusive education. In particular, OCR should concentrate on reading and English education to ensure that boys are receiving equal access to educational resources and instruction.

Chapter 3. Trends in Mathematics, Science, and Technology Education and Subsequent Employment for Girls and Women

When analyzed separately, the various measures of math and science course taking and achievement appear to give confusing and contradictory information on the extent of gender disparities in math and science education. Overall, girls and boys start out in elementary school with similar interests in math and science and equal participation in these subject areas. However, as students progress through school, societal influences and other barriers to participation result in fewer girls being interested in and taking math- and science-related courses. While there appears to be a recent trend toward equal participation in traditional math and science courses, such as chemistry, biology, trigonometry, and calculus, disparities remain at the advanced levels, particularly in computer programming, computer math, and advanced physics courses.

Achievement scores are also somewhat troubling. Although girls receive better grades than boys, their achievement scores are lower than boys' scores—often significantly lower. Scores on the 1996 National Assessment of Educational Progress (NAEP) show that, nationally, the fourth-grade boys' average score in math proficiency is higher than the girls' score. In the 12th-grade, boys' average science score is higher than that of girls. Further, when considering the percentages of students scoring at or above proficiency level in math, more 12th-grade boys than girls are in this category. Gender differences are also significant in several states. Further analyses of NAEP results show that boys are more likely than girls to be proficient in the most advanced math and science skills. Many of these findings were apparent in the 1995 Third International Mathematics and Science Study as well.

Other measures of achievement, such as SAT and ACT scores, indicate differences between men and women, but further analysis is required. For example, on the math portion of the SAT, the mean score for males was 531 in 1999, compared with 495 for females. Although the College Entrance Examination Board (the College Board), which sponsors the test, is concerned with gender differences in scores, it is not clear to what extent these differences are statistically significant and a cause for concern.

[7] *See* chap. 2, pp. 14–16, 30–32.

Nonetheless, it is important to determine the extent to which boys and girls differ in the opportunities they have in math, science, and technology. Obviously, at the college level and in careers, there are major gender gaps in these fields and, thus, significant differences in the potential and actual earnings of men and women. If there are structural barriers and Title IX violations leading to these differences, it is important that OCR become involved in eliminating such barriers. Such an inquiry should begin with the educational opportunities provided to boys and girls, particularly at the secondary school level. Although it is statistically improbable that girls and boys will always achieve the same scores, statistically significant differences in achievement and underrepresentation can be an indicator of unequal educational opportunities.

Finding: Gender differences in math and science course taking and achievement grow as students progress from middle school to high school, and become more apparent in postsecondary endeavors. While some of the gender gap in math and science education has diminished, boys remain more likely than girls to take advanced math and science courses such as computer math, computer programming, and advanced placement physics.

Furthermore, although girls' and boys' average achievement scores are similar in some respects, overall, boys outscore girls in several areas. When considering average proficiency, boys' 1996 math proficiency scores were higher than girls' math proficiency scores in the 4th grade, and boys' science proficiency scores were higher than girls' scores in the 12th grade. Further, when considering the percentage of girls and boys scoring at or above proficiency level in math, more boys than girls had the highest scores in the 12th grade. In addition, in several states, boys scored significantly higher than girls in both math and science achievement. SAT scores also show wide discrepancies, with girls scoring 36 points lower than boys.[8]

Recommendation: DOEd should conduct further analyses of achievement scores to determine the extent to which boys outscore girls on various assessments. For example, NCES, in conjunction with the College Board, should conduct an analysis of differences in SAT scores to determine if such differences are statistically significant when analyzed by such factors as state, high school program, courses taken, race, and ethnicity. OCR should use gender differences in achievement scores as a basis for initializing compliance reviews.

Finding: There is an apparent contradiction between the fact that girls are taking similar math and science courses (with the exception of more advanced/technical courses), yet have lower math and science proficiency than boys. Given that researchers have found that lower achievement can discourage students from further study in an area, it is important to determine the cause of this discrepancy between course taking and achievement, which may be an indicator of unequal treatment of girls and boys in science classes and unequal access of girls and boys to certain elements of math and science education, such as class discussions, experiments, and resources.[9]

Recommendation: In conducting compliance reviews and complaint investigations, OCR must go beyond simple course enrollment and access. Other factors, such as test scores, achievement scores, class participation, and student-teacher interaction must be considered. Absent surveys and other statistical studies designed specifically to determine civil rights violations, OCR must look beyond the available statistical facts and conduct more contextual analyses of the educational experiences of both girls and boys.

Finding: While college-bound women and men appear to be taking the courses they need, it is unclear that *all* women (and men) are being offered the guidance and support needed to succeed in math and science. Data for high school graduates indicate that gender disparities remain in the types of courses male and female students choose, suggesting that equal opportunity and strong encouragement are not standard ingredients in the high school curriculum. Further, the limited data available on course enrollment cannot clearly distinguish the quality of education received—certainly a more qualitative

[8] *See* chap. 3, pp. 33–41.

[9] *See generally*, chap. 3.

approach is needed to determine if there is equal opportunity in math, science, and technology education.[10]

Recommendation: More research on differences in course-taking patterns need to be done. DOEd's Office of Elementary and Secondary Education, in conjunction with the Women's Educational Equity Act program office, should conduct research on differences in course-taking patterns by various factors, including race, sex, school type, school location (urban, rural, etc.), course options, family background, available resources, etc. OCR should consider this information when conducting compliance reviews and investigations.

In addition, DOEd should fund qualitative research studies that examine specific groups of students and educational programs. For example, students in lower-track courses should be interviewed to determine if there are disincentives to studying math and science. Programs in science and technology magnet schools should be compared with other programs to identify possible barriers in nontechnology-oriented schools. Further, students in science and technology schools should be tracked and compared with other students to determine what the long-term outcomes are for students who receive focused encouragement and support in math and science areas.

In addition, a longitudinal study should be conducted of a current cohort of students, to determine the extent to which girls have recently made strides toward greater involvement in math and science courses. This information should be compared with the existing data from longitudinal education studies, transcript studies, and other DOEd data that may not accurately reflect the experiences of girls and women currently enrolled in elementary, secondary, and postsecondary programs.

Finding: There are various measures of academic achievement and course taking. However, in many instances the measures provide inconclusive or contradictory evidence. In addition, there have been few comprehensive analyses of course taking. The Department of Education's High School Transcript Study (HSTS) is the only nationwide, longitudinal study of course taking and course offerings that is used for policy development and implementation. Nonetheless, the most recent data for the HSTS come from the graduating class of 1994.[11]

Recommendation: The Department of Education's National Center for Education Statistics (NCES) should consider conducting smaller-scale, local-level, and qualitative studies to accompany their national studies and surveys of education. For example, after national estimates become available, NCES should determine if such findings can be replicated within smaller communities and school districts. Such studies should be done in conjunction with educators, educational researchers, and state and local governments. Findings from these additional studies should be used by OCR to determine if underrepresentation exists in various areas. Congress should provide additional funds, as necessary, to expand data collection on course taking and other civil rights issues related to math, science, and technology programs.

Chapter 4. The Department of Education: Ensuring Nondiscrimination and Gender Equity

Recognizing the importance of ensuring equal educational opportunities in advanced mathematics and science for girls and minorities, in 1994, OCR made girls' and minorities' underrepresentation in advanced mathematics and science education one of its high-priority issues. Following that announcement, OCR prepared a draft investigative manual, "Underrepresentation of Females and Minorities in Upper-Level Mathematics and Science in Secondary Schools," to assist its staff in conducting civil rights investigations related to girls and minorities in advanced mathematics and science. Although OCR staff use the draft investigative manual, the manual has not yet been issued in final form. Furthermore, since announcing that underrepresentation of girls and minorities in advanced mathematics and science classes was a high-priority issue, OCR has conducted only a handful of compliance reviews in this area.

When investigating a school district for underrepresentation of girls in mathematics and science, OCR reviews three major areas: enrollment patterns of girls in mathematics and science, the criteria for placement in advanced

[10] *See* chap. 3, pp. 35–36.

[11] *See* chap. 3, pp. 34–44.

classes, and the school district's monitoring of student progress in these courses. In addition, OCR reviews whether electives or prerequisites conflict with girls' enrollment in advanced mathematics and science classes. If OCR finds significant statistical disparities in a district's advanced mathematics and science programs, it examines the criteria used by the district for making placement decisions. If the percentages of female, minority, and limited-English-proficient students who are enrolled in the advanced courses are not significantly different from those percentages of all students in these courses, OCR generally does not investigate further.

Despite making girls' and minorities' underrepresentation in advanced mathematics and science classes a high-priority issue, for the most part OCR's Title IX compliance and enforcement program has focused on areas other than academics, primarily sexual harassment and athletics. OCR has not released definitive policy guidance on Title IX as it relates to academics generally, or to advanced mathematics, science, and technology education in particular. Thus, OCR has missed an opportunity to develop its Title IX compliance and enforcement program fully and to provide schools, teachers, parents, and students with definitive guidance on Title IX compliance with respect to academics generally and advanced mathematics and science in particular. Educational research shows the importance of including the Commission's principles in federal law, both civil rights and program statutes. Definitive policy guidance on Title IX as it relates to advanced mathematics and science would afford OCR an opportunity to emphasize the importance of incorporating the five equal educational opportunity principles into schools' Title IX compliance programs.

In addition to enactment and enforcement of Title IX, which guarantees nondiscrimination for girls and women in publicly funded educational institutions, the Federal Government has supported equal educational opportunity for girls in advanced mathematics and science through enactment of a program statute, the Women's Educational Equity Act. With this statute, Congress endowed the Secretary of Education with the authority to provide support and technical assistance to districts to implement effective gender equity policies, including the development of nondiscriminatory tests of aptitude and achievement. However, the act remains severely underfunded, and most of the important research projects relating to girls' participation in advanced mathematics and science, test and teacher bias, innovative classroom techniques, and statistical tracking projects cannot get off the ground without appropriate funding.

Finding: OCR issued a draft Strategic Plan in February 1996. However, the Strategic Plan has not been finalized. Further, the seven priorities identified in the Department's Strategic Plan do not sufficiently address OCR's civil rights priorities, nor does the plan delineate OCR's specific role in enforcing civil rights.[12]

Recommendation: OCR should finalize its Strategic Plan and set an action plan into place to achieve its goals. Further, OCR should ensure that underrepresentation of women and minorities in advanced mathematics, science, and technology is a priority. In particular, OCR should focus on access to computer science and technology courses and resources for women and minorities. In addition, rather than focusing only on the physical underrepresentation of females in advanced math, science, and technology courses, OCR should examine the ratio of boys to girls among those students who score at or above high-proficiency levels in math and science, and among those students who take and score high on advanced placement examinations in math- and science-related subjects. In cases where more boys score highly on a test, OCR should investigate to determine if discrimination has occurred.

In addition, the Department's Strategic Plan should include more specific civil rights goals and strategies, and there must be an interrelation with OCR's goals and strategies. Strategic planning should be done in conjunction with OCR and other offices that deal with civil rights issues, such as the WEEA office.

Finding: OCR states in its Strategic Plan that one of its priority areas is the underrepresentation of women and minorities in advanced math and science courses. Nonetheless, few resources have been spent on this issue.[13]

---

[12] *See* chap. 4, pp. 48–49.

[13] *See generally*, chap. 4.

Recommendation: OCR should tie its budget more closely to its Strategic Plan. Resources should be earmarked for certain issues, such as the underrepresentation of women and minorities in advanced math and science courses. Resources should be employed in this area to devise and use methodologies for targeting schools for conducting compliance reviews and technical assistance activities.

Finding: DOEd funding for civil rights issues accounts for less that 1 percent of the total funding for the agency. Further, OCR's annual reports do not describe how much resources OCR expends on issues related to equal access for women and girls in advanced math, science, and technology education.[14]

Recommendation: The Secretary of Education should allocate a higher percentage of its budget to program funding for civil rights issues, particularly in area of enhancing opportunities for girls and women in math, science, and technology. OCR should publish a more detailed picture of its expenditures that includes program-specific breakouts. This would inform the public as well as the educational community about the emphasis placed on each civil rights statute and issue area.

Finding: Program offices responsible for implementing federal programs related to mathematics and science education provide information or referrals to OCR. For example, when each applicant for financial assistance under a DOEd program completes its application package, it must sign an assurance that it will comply with civil rights laws. If the Office of Elementary and Secondary Education, in reviewing an application, receives information that an applicant or grantee may not be in compliance with civil rights requirements, it provides this information to OCR, and OCR can then conduct followup activities. If an applicant or grantee requests from OESE information or technical assistance on civil rights issues, OESE will refer that applicant or grantee to OCR.

Because the program office's civil rights function is limited to reviewing assurance forms, OCR's role in the grant review process is also limited. OCR reviews regulations proposed by program offices, including selection criteria, for civil rights concerns. OCR also follows the memorandum of understanding between program offices closely. However, OCR does not have a formal memorandum of understanding with OESE that clearly defines collaborative efforts that can be undertaken by OCR and OESE to ensure equal educational opportunities for girls in upper-level mathematics and science.

Comparatively, the memorandum of understanding between OCR and the Office of Special Education and Rehabilitative Services (OSERS) serves a number of important objectives such as investigation of educational agencies; the negotiations of remedies for violations found; the monitoring of compliance plans; and the exchange of information and joint opportunity to conduct joint technical assistance activities. In addition, it offers OCR the opportunity for an improved understanding of the pedagogical aspects of educating children with disabilities. It also provides informational resources that assist in developing remedies or offering alternative nondiscriminatory educational criteria and practices to schools.[15]

Recommendation: OCR should develop a memorandum of understanding with OESE, similar to the existing memorandum of understanding between OCR and OSERS. If developed and implemented properly, a memorandum of understanding with OESE could provide more effective Title IX implementation, compliance, and enforcement and enhance DOEd's efforts to ensure equal educational opportunity for girls in advanced mathematics, science, and technology as the memorandum of understanding with OSERS does for students with disabilities.

Like OCR's memorandum of understanding with OSERS, a memorandum of understanding between OCR and OESE should allow these offices to undertake jointly, by mutual agreement, technical assistance; investigation of any educational agency; the issuance of findings under Title IX; the negotiations of remedies for violations found; the monitoring of compliance plans; and appropriate enforcement proceedings. The memorandum of understanding should specify that when policy is being formulated, by either OCR or OESE, on any issue concerning equal educational opportunities for girls in upper-level

[14] *See* chap. 4, p. 49.

[15] *See* chap. 4, pp. 50–54.

mathematics and science, every effort will be made to consult on the issue before issuance of the policy.

The memorandum of understanding should indicate that OCR and OESE will exchange information and materials in the area of girls in upper-level mathematics and science for dissemination to OCR regional offices, regional resource centers, and other OESE technical assistance centers, as appropriate. OCR should provide information on its regional offices' technical assistance contact persons, technical assistance training courses, products and materials from its central inventory, and reports containing technical assistance information. OESE should provide information on scheduled events and meetings relating to girls in upper-level mathematics and science, OESE staff technical assistance plans, services and activities of regional resource centers, and products and materials related to technical assistance. The memorandum of understanding also should recognize that OCR and OESE can engage in joint technical assistance activities, such as development of materials and training packages and participation in conferences.

Finding: The Women's Educational Equity Act and other federal program statutes support the principles of Title IX and can be useful for promoting equal educational opportunity for girls in advanced mathematics and science education. The Women's Educational Equity Act, originally enacted in 1974 and most recently reauthorized in 1994, seeks to promote educational equity in access to and participation in academic coursework and professional careers for girls and women. The act also is designed to promote equity for women and girls who experience discrimination on multiple bases, such as gender and race, ethnicity, limited English proficiency, national origin, disability, or age. In addition, the WEEA program also addresses perceptions of gender roles based on cultural differences and stereotypes.

However, funding for the WEEA program has been inconsistent. WEEA received zero funding in fiscal year 1996. In FY 1999, WEEA received $3 million; however, this figure is insufficient to cover the costs of full funding for all WEEA continuation grants. The severely limited funding for the Women's Educational Equity Act has prevented DOEd from accomplishing many objectives that are important to ensuring equal educational opportunity for girls in advanced mathematics and science. Current grantees and educators interested in significantly increasing school-to-work opportunities for minorities, women, and individuals with disabilities claim that if WEEA loses its authorization, opportunities for students to prepare for careers that are not traditional for their race, gender, or disability will diminish.[16]

Recommendation: The Federal Government should continue to ensure that civil rights enforcement officials and educational experts work together through its Title IX enforcement and its funding and administration of important program statutes such as the Women's Educational Equity Act. Congress should fund the WEEA at higher levels than it has in recent years. Congress should earmark funds and strongly encourage the Secretary of Education to actively seek out researchers developing projects on innovative textbooks, curricula, and other materials designed to achieve equity for women and girls (particularly in mathematics and science); nondiscriminatory tests of aptitude and achievement and on alternative assessments that eliminate biased instruments from use; and innovative strategies and model training programs for teachers and other educational personnel.

Finding: Many of the most requested items distributed by the Women's Educational Equity Resource Center are related to gender equity in math, science, and technology, suggesting that there is a need for information in this area.[17]

Recommendation: The WEEA program should increase funding for programs related to gender equity in math, science, and technology. The WEEA Resource Center should use these funds to develop a survey to elicit information from schools and school districts across the country on their concerns about gender equity in math and science. To target the greatest need for technical assistance or outreach and education, the survey should ask schools about their concerns over or interest in issues such as parental involvement, equity training for teachers and counselors, the use of information technology,

---

[16] *See* chap. 4, pp. 51–53.

[17] *See* chap. 4, p. 52.

and single-sex education. The center should use the results of the survey to determine the specific issues of greatest concern or interest. Based on the results of the survey, the WEEA Resource Center should award contracts to outside agencies and organizations to develop appropriate written materials, create public service announcements, or commission the use of any other media necessary to address the areas of concern.

Finding: In 1996, the Commission released *Equal Educational Opportunity Project Series, Volume I*, a precursor to this report. Volume I examined the federal agency that now holds the primary responsibility for issues related to education, the Department of Education, and the office within the Department responsible for civil rights matters, the Office for Civil Rights. One of the issues addressed in volume I was the difficulty faced by female students in gaining equal access to advanced mathematics and science courses and the role of Title IX enforcement in ensuring such access. Among the Commission's findings was that OCR had not developed sufficient policy guidance on Title IX enforcement issues.[18]

Recommendation: To address this deficiency, the report recommended that OCR "maintain a continuing effort to remain aware of the major judicial cases and education issues arising on . . . Title IX" and "make every effort to produce policy guidance or clarification where necessary."[19] The report also recommended that in order to more effectively develop technical assistance, outreach, and educational materials, OCR should expand the disciplines of the team members assigned to develop these materials.[20] In the case of Title IX enforcement in the academic setting, this would mean hiring or contracting with educators, sociologists, and other researchers doing work in the field of gender equity in education, and/or working collaboratively with the WEEA office for its input on OCR's technical assistance, outreach, and educational materials.

Finding: OCR's policies, in conjunction with its regulations, should create a strong foundation for OCR's civil rights compliance program. OCR asserts that it takes the policy process very seriously and tries to balance OCR's agenda.[21] However, although OCR made girls' access to advanced mathematics and science education a high-priority issue, OCR has not developed major new policies relating to girls in mathematics and science since adopting the Strategic Plan.[22]

Recommendation: OCR should develop policy guidance that establishes clearer criteria for ensuring equal educational opportunities for girls in advanced mathematics, science, and technology. OCR should rely on the five Commission principles as the foundation for developing such policy: (1) structuring educational programs to serve a diverse population; (2) using neutral and nondiscriminatory screening procedures to place students in mathematics, science, and technology education programs; (3) providing parental notification and encouraging parental involvement; (4) evaluating and allocating teachers, counselors, and other educational resources before the development and during the implementation of educational programs; and (5) eliminating barriers, providing equal access, and promoting gender equity in all subjects, activities, and career opportunities.

Policy guidance should inform school administrators, faculty, students, and parents of their rights and responsibilities under Title IX. It should clarify and elaborate the legal standards on which OCR relies in conducting its enforcement activities, explaining in lay terms the requirements of Title IX in relation to gender equity in math, science, and technology. Such guidance should establish clear, practical meanings for the requirements found in the Title IX regulations through the use of specific criteria and examples. OCR might pattern such a policy guidance on its September 1991 Title VI/*Lau* policy update. This policy guidance provides a detailed discussion of specific compliance standards and the statutory, regulatory, and case law analyses on which they are based. For example, the Title VI/*Lau* policy update discusses such specific compliance-related issues as teacher qualifications, denial of effective or equal

---

[18] *See* chap. 4, pp. 60–65.

[19] U.S. Commission on Civil Rights, *Equal Educational Opportunity Project Series, Volume I*, December 1996, p. 258.

[20] Ibid., p. 262.

[21] *See* chap. 4, p. 60.

[22] *See* chap. 4, pp. 60–65.

participation for students with limited English proficiency, and segregative effects of such a denial of participation. In addition, the Title VI/*Lau* policy update discusses case law that has influenced the development of OCR's compliance standards for specific compliance issues.

A policy guidance document similar to the Title VI/*Lau* policy update addressing Title IX compliance as it relates to gender equity for girls in mathematics and science education should include compliance standards relating to such issues as student placement practices; classroom interactions between teachers and students; counseling activities; disparities across gender lines in enrollment, grades, classroom participation, educational materials and facilities; parental notification and involvement; future pursuit of math and science as college majors and in careers; and tests and other appraisal materials. As in its Title VI/*Lau* policy guidance, OCR should address case law that is on point and offers guidance in developing analytical frameworks for specific compliance-related issues or has influenced the development of OCR's compliance standards for such issues. Examples of cases that would be useful to discuss in such a policy document might include *Vorchheimer v. School District of Philadelphia* (addressing the legality of single-sex educational programs) and *Sharif v. New York State Education Department* (finding a Title IX violation relying on a disparate impact analysis against New York's state educational agency for relying solely on the SAT, a standardized test, in determining eligibility for scholarships based on math and science ability).

Finding: In August 1994, OCR released its draft investigative manual, "Underrepresentation of Females and Minorities in Upper-Level Mathematics and Science in Secondary Schools," which was prepared by a team of OCR staff members with expertise in the area drawn from throughout OCR. The investigative manual provides comprehensive guidance to investigators conducting compliance reviews on the underrepresentation of females and minorities in higher-level mathematics and science courses. Although it recognizes that "developing sound investigative approaches to the issue presents a daunting challenge," the investigative manual provides step-by-step guidance on how to target recipients for compliance reviews, investigative approaches to use, and the legal standards that apply. In the absence of OCR policy specifically on the underrepresentation of girls in mathematics and science, OCR developed the investigative manual by drawing analogies and information from other OCR policies and guidance.[23]

Recommendation: OCR should formally issue its draft investigative manual on the underrepresentation of females and minorities in upper-level mathematics and science education. In addition, OCR should expand on the information contained in this investigative manual in a separate investigative guidance targeted specifically to issues related to equal participation for girls in advanced mathematics, science, and technology education, particularly educational programs focusing on computer technology. OCR should issue Title IX policy and investigative guidance specifically addressing this issue.

Finding: In its draft guidance, OCR has stated that "[t]he ultimate goal in selecting schools [and] districts for compliance reviews is to get those that have some indicator of compliance problems and thus are more likely to operate their upper-level/track mathematics and science programs in a manner that discriminates against females and minorities."[24]

Recommendation: To attain this goal, OCR should charge its Survey and Statistical Support Branch in headquarters with obtaining and analyzing the data that would be required to perform adequate representation determinations for each high school. The Department of Education has access to a vast amount of enrollment data related to math and science courses. OCR headquarters should take the lead in acquiring, analyzing, and disseminating such data to the regional OCR offices, and in developing criteria for the offices to use in evaluating whether the data indicate potential compliance problems.

Finding: OCR's resource guidance briefly summarizes requirements of Title IX that relate to underrepresentation of girls in mathematics and science, including the Title IX provisions on appraisal and counseling materials, testing instruments, internal control, and disproportionate classes. It provides abstracts of relevant re-

[23] *See* chap. 4, pp. 60–64.

[24] *See* chap. 4, p. 61.

search reports on girls and minorities in mathematics and science.

These abstracts are useful in encouraging OCR investigators to become familiar with educational research on girls' access to and participation in advanced mathematics and science. In addition to these research abstracts, the resource guidance recommends educational strategies to increase the effective participation of female and minority students in mathematics and science. It also contains sections on federal and model programs used by school districts to increase the effective participation of female and minority students in mathematics and science. These sections can be particularly useful in providing OCR's investigators with the knowledge they need to assist school districts in remedying discrimination and promoting equal educational opportunity.[25]

Recommendation: If it were updated regularly, the resource guidance could be an extremely beneficial resource for OCR staff in conducting cases related to girls' access to and participation in advanced mathematics and science. OCR should collaborate with the WEEA office to update and expand this guide. Further, the guide should be used as the basis for a technical assistance document for administrators and faculty to consult as needed. In addition, this guide should be available on the DOEd Web site.

Finding: In 1996, OCR targeted the underrepresentation of girls in advanced mathematics and science education as among its priorities for the coming fiscal years. However, it appears from a Commission review of documents filed on OCR's Electronic Library, that OCR has conducted only a handful of compliance reviews and complaint investigations based on Title IX and girls' access to and participation in advanced mathematics and science education. OCR has done few compliance reviews targeting Title IX and academics generally. The reviews OCR has conducted have not found problems with respect to girls in advanced mathematics and science.[26]

Recommendation: Over the next few years, OCR should increase the number of Title IX compliance reviews focusing on girls' access to advanced mathematics and science to ensure that its proactive Title IX enforcement program has dealt adequately with this priority issue. To aid this effort, OCR should develop specific criteria that should be applied in targeting sites for compliance reviews. OCR should obtain and distribute statistical data on enrollment and test scores to be used as criteria in the analysis, as well as the specific numerical parameters for these data that may be used in determining whether a compliance review should be performed on a particular school.

Finding: It is crucial that school officials clearly and fully understand their responsibilities under federal civil rights law. OCR's letters of finding are the most important written contact between OCR and the local school districts whose efforts to comply with Title IX's nondiscrimination prohibition OCR evaluates. Second, OCR can present in its letters of finding important information such as a detailed recitation of the legal and policy background of Title IX as it relates to specific compliance issues and to Title IX compliance generally.

OCR's letters of finding present the opportunity to achieve the goal of communicating important information. Despite the opportunity OCR's letters of finding present, a review of OCR case letters reveals that in its letters of finding addressing Title IX compliance relating to girls in mathematics and science education, OCR generally has not provided a thorough explanation or analysis of OCR policy on important compliance issues affecting local school districts' Title IX obligations. OCR has failed to provide recipients with a thorough analysis of OCR Title IX policies relating to the participation of girls in mathematics and science education. In particular OCR's letters of finding in Title IX cases, lack a cohesive articulation of the substantive or procedural analyses it uses in implementing and enforcing Title IX.[27]

Recommendation: OCR should use its letters of finding to disseminate to state and local school district officials, in a detailed and thorough fashion, the basis for the civil rights obligations Congress created in Title IX. OCR therefore should focus carefully and systematically on ensuring clarity and thoroughness in the prepa-

[25] *See* chap. 4, pp. 64–65.

[26] *See* chap. 4, pp. 65–68.

[27] *See* chap. 4, pp. 67–68.

ration, development, and execution of its letters of finding. OCR should present the information in its letters of finding in a thorough and detailed manner, in order to ensure full awareness and understanding among school officials, parents, and students of the basic importance and continuing relevance of Title IX's prohibition against discrimination on the basis of sex. In particular, OCR should ensure that its letters of finding help school officials and stakeholders in the school community, particularly parents and students themselves, to recognize that Title IX's legal obligation derives from the larger civil rights theory of equal protection of the laws; that Title IX's legal obligation encompasses crucial elements of equal protection theory as it has been applied by Congress, the courts, and the executive agencies in the context of classifications based on sex; and that these elements include the policies of gender equity, equal access, effective or equal participation, and equal educational opportunity.

OCR legal and compliance staff should take into account that there may be school districts where officials and key personnel such as faculty and administration do not fully understand the requirements of the Title IX statute and its regulations. OCR's letters of finding should provide information on the specific content and requirements of the Title IX regulations to which it refers. The letters of finding should indicate whether there are any relevant regulatory provisions for this compliance review. OCR should avoid presenting legal obligations in a cursory manner, without sufficient elaboration, detail, or specificity to assist school officials in taking the steps necessary to ensure compliance with Title IX requirements.

OCR's letters of finding should provide the clearest, most precise, most readily accessible language in explaining the civil rights laws, regulations, and policies on which OCR bases its compliance and enforcement activities. At a minimum, OCR should ensure that letters of finding and other written contacts with school districts provide the districts with the most complete and thorough analysis of OCR policy possible, so that school districts will know exactly what the policy is and what standards are applied. In addition, OCR should explain in practical terms the meaning of the legal terminology it uses.

Finding: In April 1996, OCR released a promising practices document titled "Access for Women and Minorities to Mathematics and Science Programs and Gifted and Talented Education Programs." OCR emphasizes this technical assistance document is "primarily intended to be a starting point to help districts with an underrepresentation problem see what has been done and what can be done and to give them potential contacts to explore appropriate strategies."[28]

In addition, OCR created a technical assistance brochure to assist schools in complying with civil rights requirements and promoting equal educational opportunity for girls and minorities in advanced mathematics and science. The brochure titled "What Schools Can Do to Improve Math & Science Achievement by Minority and Female Students" provides background information on girls' and minorities' lower achievement and participation levels in advanced mathematics and science, lays out the specific requirements of Title IX and Title VI related to the issue, and suggests policies and practices that, while not required by law, can promote equal educational opportunity for girls and minorities in advanced mathematics and science. The brochure offers specific suggestions for mathematics and science teachers, department heads, counselors, principals, and school districts as a whole.[29]

Recommendation: OCR should update and expand these documents and should distribute them widely to elementary and secondary schools. OCR should not wait until it schedules technical assistance presentations to distribute these or any technical assistance materials. In addition, these materials should be available on the DOEd Web site.

Chapter 5. Using Neutral and Nondiscriminatory Screening and Diagnostic Procedures

Screening and diagnostic procedures are widely used in the identification, evaluation, and assessment of students' abilities for placement purposes. Screening procedures include teacher evaluations, grade requirements and, most commonly, test scores. Because these procedures are critical to the educational opportunities and, thus, development of students, identifying and

[28] *See* chap. 4, pp. 68–69.

[29] *See* chap. 4, p. 69.

preventing bias are crucial to eradicating the differences in educational attainment, particularly between boys and girls in math and science. If screening and diagnostic procedures are in any way nonneutral or discriminatory, students can be inappropriately or detrimentally evaluated.

The issue of test bias is particularly relevant to girls in advanced math and science education because scores on standardized tests purporting to measure intelligence or achievement commonly are used to place students in programs deemed educationally appropriate. Critics of this approach to student assessment argue that test scores may not accurately reflect the abilities of a particular student, or group of students, because of gender, cultural, and socioeconomic biases. For example, if a test provides an inaccurate assessment of males' and females' abilities to learn math and science, with girls scoring consistently lower, girls may be prevented from enrolling in math and science courses they would be capable of successfully completing. When evaluating a test for "sex fairness," evaluators need to examine the content for sex stereotyping and for fair representation; whether males and females perform differently on specific test items; and the influences related to differences in performance (i.e., different educational experiences).

There are a couple of legislative vehicles through which the monitoring and enforcement of nondiscriminatory screening and diagnostic procedures can occur. The Women's Educational Equity Act (WEEA) of 1994 addresses neutral and nondiscriminatory screening and diagnostic procedures by authorizing the Department of Education to provide support and technical assistance to implement effective gender equity policies. Title IX requires elementary and secondary schools to use neutral diagnostic and screening procedures for the placement of girls in educational programs. The protections provided by Title IX prohibit the use of discriminatory appraisal and counseling materials and include language prohibiting the use of sex-biased testing.

OCR has conducted few compliance reviews and has received few complaints specifically addressing screening and diagnostic procedures. There has also been little Title IX litigation directly relating to gender equity for girls in screening and diagnostic procedures for mathematics and science education. Nonetheless, OCR has issued general draft guidance on the use of achievement, aptitude, and other "high-stakes" testing applicable to Title VI and Title IX. In general, the draft guidelines describe civil rights compliance standards used by OCR and the courts. It contains a thorough discussion of legal principles related to test use and civil rights. The guidelines are accompanied by a brief background piece in the form of an information pamphlet, titled "Test Use and Civil Rights," which sets forth OCR's view on why test use is important and illustrates several consequences of testing for individual students.

In addition, OCR developed a draft guidance, "Fairness in Testing," in 1995 which outlines the parameters to be used in OCR investigations on fair testing. OCR investigators may look at both disparate treatment and disparate impact when determining whether a test is discriminatory. There may be several responses to correcting a violation, depending on the facts of a case, including supplementing the use of a test with other assessment measures, revising the test instrument, substituting the test with another more valid instrument, and enhancing students' abilities to perform well on the test. In assessing student placement in advanced mathematics and science courses, OCR reviews a school's placement criteria. OCR's position is to require multiple identification and evaluation mechanisms for placement decisions. Although OCR permits schools to use validated IQ tests for their intended purpose, in cases where OCR finds a violation, it requires schools to provide other forms of screening, including portfolio reviews, grade reviews, or teacher recommendations for students who do not test well.

OCR has also produced a number of technical assistance documents with regard to nondiscriminatory screening and diagnostic practices. OCR has assisted state departments of education and local school districts in developing materials that specifically address the ways in which policies and practices such as screening and diagnostic procedures, including testing in the classroom and standardized tests, can entrench discriminatory practices and outcomes.

Finding: The controversy over gender bias in testing emanates from concerns about the validity of the scores derived from standardized tests, and the use of those scores to place and admit

students into certain programs. The requirements for a specific mathematics or science course such as algebra, geometry, biology, or physics; or an advanced math or science program such as honors or advanced mathematics and science, can range from no specific eligibility requirements other than personal interest and choice to specific grade requirements, test scores, or teacher recommendations. These procedures can ensure appropriate placement. However, research indicates several key problems in the development and implementation of screening and diagnostic procedures, such as test bias. The presence of biased or potentially discriminatory actions can interfere with the screening and diagnostic process to identify, evaluate, and place girls in advanced mathematics and science courses and programs.

Gender-biased tests provide an inaccurate assessment of male and female abilities and impede girls' enrollment in mathematics or science classes that they are perfectly capable of successfully completing. Gender bias in testing raises concerns of equal educational opportunities for girls in mathematics and science. This is an especially relevant issue when one considers that girls begin their academic careers scoring higher on standardized tests than boys in almost every subject, including mathematics and science, and then experience a decline around middle school continuing throughout high school. Assigning students to mathematics and science classes can have a negative effect if a school establishes rigid pupil placement policies for classes based exclusively on general tests of performance or ability. In these situations, students in the lowest tracks can be stigmatized by teachers or peers as poor learners.[30]

Recommendation: When evaluating tests for gender fairness, the Commission recommends three approaches that have been identified by educational researchers: First, educators should examine the test content for the perpetuation of sex-role stereotypes and unfair representation of women. Second, educators should determine if boys and girls perform differently on achievement test items, and if so, they should investigate the source of that disparity. Third, educators should examine the factors that influence sex differences in performance.

In addition, OCR should develop a compliance strategy that incorporates investigation of gender bias in classroom interaction to determine the extent to which such bias may result in adverse effects such as lower scores on standardized tests. OCR should work with schools to ensure against gender bias by conducting outreach and education efforts such as conferences, forums, and town meetings. Such efforts should include written information prepared by educational experts on gender bias in classrooms. In addition, OCR should ensure widespread dissemination to recipients of such materials.

Finding: The use of tests in the placement of girls in advanced mathematics and science courses has been under close scrutiny, especially by researchers. They continue to express concerns over the validity of the scores derived from these tests, especially standardized tests. These tests are used to measure student intelligence and make achievement projections, as well as to place students. So influential are these tests that they have become the primary tool for placing children into ability groupings. However, researchers have questioned how well scores on tests are correlated with a student's ability or achievement in mathematics and science. Studies recommend that when there is a significant disparity in test scores by gender, there should be: (1) a review of testing instruments; (2) a review of achievement test scores when results show significant differences by gender; and (3) at the high school level, a review of test score differences between boys and girls to determine if the scores reflect sex bias in the content of the test, or are a result of fewer girls taking mathematics and science courses.[31]

Recommendation: OCR should conduct compliance reviews to determine whether there is gender bias in achievement and aptitude tests, particularly in schools where there is an underrepresentation of girls in advanced placement mathematics, science, and technology or gifted and talented math and science programs. In addition, OCR should conduct technical assistance, outreach, and education to help schools to use neutral, nondiscriminatory screening and diagnostic procedures for all decisions related to stu-

[30] *See* chap. 5, pp. 70–74.

[31] *See* chap. 5, pp. 70–74.

dents' placement in mathematics and science courses, tracks, or ability groups.

Finding: Title IX requires schools to use neutral and nondiscriminatory diagnostic and screening procedures for the placement of students in educational programs. In addition, the Women's Educational Equity Act of 1994 provides for assistance to schools in developing nondiscriminatory screening and diagnostic procedures. However, WEEA has provided little assistance in this area. Nonetheless, programs and practices developed in accordance with the goals of WEEA in regard to nondiscriminatory testing would enable schools to develop neutral and nondiscriminatory screening and diagnostic procedures in placing students in mathematics and science education.[32]

Recommendation: The WEEA program office should solicit proposals and provide grants for projects geared toward studying and eliminating gender bias in testing. Further, the WEEA office and OCR should work together to develop technical assistance materials on neutral and nondiscriminatory diagnostic procedures. These materials should be based on educational research and effective practices used by school districts and reviewed by OCR to ensure nonbias in testing.

Finding: OCR has issued general draft guidance on the use of achievement, aptitude, and other high-stakes testing applicable to Title VI and Title IX. In general, the draft guidelines, released in April 1999, clarify and describe civil rights compliance standards used by OCR and the courts. It contains a thorough discussion of legal principles related to test use and civil rights.

The draft guidance is a strong document that sets forth existing law in a clear, thorough, and detailed fashion accessible to the general public, thereby making it valuable to educational recipients of federal funds and their beneficiaries. The strength of the document rests in part on its efforts to show the connection between the somewhat abstract legal standards it discusses and the actual discrimination faced by students. For example, the guidance makes an implicit connection between the need for the rigorous "educational necessity" standard and the potential for discrimination based on testing programs by observing that the educational decisions being made based on the tests are decisions of immense consequence to students. A student's entire academic career can depend on a single examination. Therefore it is extremely important for DOEd to make this connection between applicable legal standards and actual discrimination to show that OCR *must* apply the most rigorous possible scrutiny to testing programs and practices. As the draft guidelines appropriately note, these are high-stakes tests. Some educational institutions are making the stakes so high in fact, that for OCR to apply a lesser standard would allow rampant discrimination on the basis of disparate impact to occur, discrimination made expressly illegal under the Title VI and Title IX regulations that OCR enforces.[33]

Recommendation: The Commission commends OCR on its initiative in developing this guidance. OCR should immediately issue this guidance in final form. In addition, OCR should either revise the guidance or develop a separate guidance providing specific discussion and analysis, including illustrative examples, relating to gender differences in high-stakes testing. In particular, OCR should address the appropriate disparate impact analysis to be applied in cases involving lower test scores disproportionately affecting one gender, such as lower math scores for girls on the SAT.

Finding: OCR provides technical assistance information for dissemination among staff on such important gender equity-related issues as gender bias in testing. For example, OCR developed a technical assistance document in 1993 titled "Equal Opportunities for Girls and Women to Participate in Math and Science." This document states in part that "[r]esearch shows that one result of bias in standardized testing is that test scores may provide an inaccurate picture of girls' and boys' abilities. With respect to gender equity, the selection of test items with different characteristics is critical." This information appears useful for OCR staff. However, this document would be more persuasive if it contained references for the propositions it states as facts.

---

[32] *See* chap. 5, p. 74.

[33] *See* chap. 5, pp. 75–76.

Citing of sources would make this a stronger document.[34]

Recommendation: OCR should develop technical assistance materials that cite to sources for the propositions they advance in resource guidance materials. For example, the 1993 document titled "Equal Opportunities for Girls and Women to Participate in Math and Science" should provide substantial citations from the work of educational researchers to support propositions it contains. OCR should update its technical assistance materials addressing gender equity and equal or effective participation for girls in mathematics and science education.

Chapter 6. Facilitating Girls' Achievement: Parents, Teachers, Counselors, and Resources

Parents, teachers, counselors, and other school resources play pivotal roles in the education of the nation's youth. Parents play a significant role in the educational development of their children. Not only do they influence their children's perceptions, attitudes, and decisions about careers, but also the type of education they receive. In particular, educators have found that parents have enormous influence over their daughters' participation in mathematics and science. If parents are fully aware of the importance of comprehensive math and science education, they will be better able to work with schools to ensure that the curriculum benefits boys and girls equally. Parental notification and inclusion are critical elements in the legislation and regulations ensuring equal educational opportunities and nondiscrimination for all children.

Several federal statutes that fund gender equity programs and projects address the importance of parental involvement in educational programs, most specifically in the context of education for students with disabilities and limited English proficiency. OCR has not issued any policy guidance on parental notification and involvement as it applies to female students in math and science education; however, it has included parental involvement in its outreach efforts for school districts, including a brochure offering suggestions on how parents can encourage their daughters to pursue math and science courses. OCR's draft investigative manual directs staff to consider parental notification and involvement with respect to the availability of upper-level courses, as well as in counseling and guidance services.

The types of instruction and guidance received by girls in math and science also are major influences on their decisions to pursue advanced studies in those areas. Teacher and counselor recommendations and referrals also play a significant role in student placement in courses. Research suggests that teachers interact differently with girls than with boys, particularly in math and science classes, often unintentionally reinforcing gender stereotypes. It has also been documented that counselors continue to steer women away from careers in math, science, and technology. When appropriate counseling services are not provided, or if counselors' suggestions or opinions are in conflict with students' interests, students can end up being discouraged from pursuing their goals and limited in their opportunities. Despite the prevalence of teaching and counseling practices that may hinder girls' academic achievement, OCR has not found any violations of Title IX relating to discriminatory treatment of girls based on the effects of teachers' and counselors' actions.

Federal programs have attempted to address how the actions of teachers and counselors can adversely affect girls' participation in math and science education. For example, the WEEA sponsors programs to eliminate bias through teacher training. However, the nondiscrimination provisions of Title IX do not specifically address teacher education or training with regard to opportunities for girls in math and science. Further, OCR has not issued any policy guidance in these areas. OCR does, however, specifically address counseling services in its Title IX regulations, which state that schools may not discriminate against any student on the basis of sex in counseling or guidance. In addition, OCR provides some technical assistance in this area and has published a brochure that offers policies and practices teachers can use to foster girls' participation in advanced math and science. OCR also has a resource guidance document on the importance of equitable counseling.

In addition to parents, teachers, and counselors, educational resources and materials are also critical to the learning environment. Ensuring equity in access to and content of educational resources is critical for ensuring equal educational opportunities. Research indicates, how-

[34] *See* chap. 5, pp. 78–79.

ever, that girls do not have equal access to technology or science instruments and that many educational materials are still gender biased. For example, several studies report that many textbooks and other resources portray girls and women in stereotypical roles, and often women are entirely missing from science texts. Educational literature on gender differences in public education suggests a direct correlation between gender bias in educational materials and the participation and achievement of girls in various subjects. Congress has thus recognized the importance of evaluating educational material by authorizing the WEEA program to provide funding for programs designed to develop and evaluate model curricula, textbooks, software, and other educational materials.

The Title IX regulations do not specifically address providing equal access to technology, but they do stipulate that benefits and services must not be denied or provided differently on the basis of sex. Thus, schools cannot discriminate in providing access to instructional resources. OCR has not produced any policy guidance specifically addressing access to resources and educational materials. Additionally, the Title IX regulations do not prohibit the use of gender-biased materials, but OCR has developed technical assistance documents on the use of nonbiased materials. Although OCR has no jurisdiction to regulate educational materials, it suggests that schools appraise their resources to ensure that girls are adequately and nonstereotypically portrayed in texts and illustrations.

Finding: Educational researchers and advocacy groups in gender equity have long recognized the influence parents have on their daughters' equal or effective participation in mathematics and science. They cite numerous reasons why parents tend to direct more attention to their sons' participation in these subjects. For example, some parents feel that they lack sufficient knowledge about these areas, or they, particularly the mothers, were not encouraged to take these courses as students. Research findings show that when girls are not encouraged in the home and school environments to take mathematics and science courses, it is very unlikely that they will pursue those subjects or career fields. Without collaboration between educators and parents, gender bias in the curriculum will remain. Today, with the focus on technology, parents need to be provided information to make them aware of the importance and relevance of this element of girls' education. The participation of girls in mathematics and science will increase if parents are exposed to these courses through outreach and other parent-incentive programs. Parents will also benefit by involvement in their children's education. They will better understand how teaching mathematics has changed and the importance of mathematics education, and will gain improved confidence in their ability to help their children.[35]

Recommendation: Federal, state, and local educational entities should include parental involvement as a component in their strategies to increase the participation of girls and women in mathematics-, science-, and technology-related fields. Such initiatives should include outreach activities, as well as roles in curriculum development, placement, and planning in these subjects. Educators and school administrators should work closely with parents when designing science and math curricula to ensure that the interests and perspectives of all students are represented. Parents should also be encouraged to participate in after-school academic programs, such as science camps and field trips. Those parents who have careers in science and technology industries should serve as mentors and role models for students interested in pursuing these fields of study. The Department of Education should also provide assistance to parents who want to improve their own knowledge in the areas of math, science, and technology through school-sponsored adult education courses or designated parent-children partnership days where parents can spend time in school observing their children's classes.

Finding: Congress has recognized the importance of parental involvement in federal statutes and programs, such as the Dwight D. Eisenhower Professional Development Federal Activities Program. Legislation creating the program includes a provision requiring recipients to develop strategies that can involve parents in the program or project.[36]

---

[35] *See* chap. 6, pp. 80–82.

[36] *See* chap. 6, pp. 83–84.

Recommendation: Congress should increase funding for programs designed to encourage parental involvement in education. Recipients of funding from the Eisenhower and other similar programs should be monitored to ensure that parental involvement is heightened and that parents are incorporated in every activity. The Department of Education should provide grants to school districts that have tried to establish solid parental involvement initiatives and should encourage the replication of successful efforts by funding pilot programs and partnership efforts between schools. In addition, standards for parental involvement in mathematics and science information and activities should be established so that the variation between school districts is minimized.

Finding: OCR's draft investigative manual on underrepresentation of women and minorities in mathematics and science states that OCR may determine in its review of a school district whether students and their parents are made aware of the availability of upper-level mathematics and science courses and whether parents of female students are included when counseling and guidance are provided to students in these subject areas. OCR can also examine the manner in which parents are included in the sessions. However, school districts are not required under regulations to provide such notification unless it is shown that the lack of it impedes the opportunity for the students to participate. Also, the manual only covers parental notification for upper-level mathematics and science courses, and not for other related courses throughout the public school system.

OCR provides a pamphlet for elementary and secondary school administrators, counselors, and teachers on how to improve mathematics and science achievement for girls. It includes 11 suggestions for involving parents in mathematics and science programs. However, it is unknown how many school districts are aware of the pamphlet or are using the initiatives OCR proposes.[37]

Recommendation: OCR clearly recognizes the importance of parents' roles in mathematics and science education, and should encourage schools to involve parents through technical assistance, outreach, and education activities, including wide dissemination of its pamphlet offering suggestions for involving parents in mathematics and science programs. Furthermore, OCR should ensure through its investigative guidance that OCR staff address parental involvement during the course of investigations relating to participation of girls in math and science. OCR should include parental involvement components in negotiated agreements resulting from these investigations. The investigative manual should also outline for investigators suggested remedies for lack of parental involvement.

Finding: In recent years, several influential studies have pointed to interactions between teachers and students as a major cause of gender differences in participation in advanced mathematics and science. These reports relied on research suggesting teachers interact differently with girls than with boys. Specifically, teachers have been found to have higher expectations for boys than girls, often expecting girls to be less assertive than boys in mathematics and science and, therefore, may encourage girls less than boys. Studies have found teacher encouragement affects students' confidence, and since girls tend to receive less societal encouragement to participate in mathematics and science, influence of teachers may be more important for girls than boys. According to other research, women who pursue scientific studies at a postsecondary level cite encouragement provided by teachers while in high school as essential to their career choices.[38]

Title IX does not specifically address teacher education or training with respect to mathematics and science. Subsequently, OCR has not developed policy guidance on girls in mathematics and science relative to teacher preservice and inservice training. Furthermore, in its draft investigative manual on underrepresentation of girls in upper-level mathematics and science, OCR does not address teacher education.

OCR does, however, have technical assistance materials on mathematics and science for teachers and school districts. The documents encourage teachers to view their role as important to ensuring gender equity in mathematics and science education. For example, OCR's technical assistance brochure, "What Schools Can Do to Improve Math & Science Achievement by Mi-

[37] *See* chap. 6, pp. 86–88.

[38] *See* chap. 6, pp. 87–92.

nority and Female Students," offers several policies and practices that teachers could use to foster girls' and minorities' participation in advanced mathematics and science. The brochure supports OCR's compliance activities because of its emphasis on educating school districts about the purpose and goals of Title IX generally.[39]

Recommendation: Teachers and administrators should use teaching methods designed to encourage the meaningful participation of girls in mathematics and science courses and programs. Teachers should be exposed to these teaching methods during preservice and inservice training. Such teaching methods should be used by elementary school teachers to provide girls with a positive foundation in mathematics and science early in their academic careers that will prepare them for advanced courses in high school and college.

Teachers should also be required to undergo periodic diversity training as a part of the accreditation process and should be kept apprised of ongoing research in this area. Periodic monitoring of teachers by school administrators will assist in the identification of unintentional teacher behaviors and interactions that might hinder equal academic development of boys and girls. In addition, during compliance reviews assessing the underrepresentation of girls in math and science, OCR should observe teacher interactions with students to determine if there are discriminatory practices hindering girls' participation in these subjects. OCR should work with the WEEA office to develop guidelines for investigators in determining what behaviors could be detrimental to girls and then should widely disseminate their findings in the form of a resource guideline to educators.

OCR should specifically address teacher education or training with respect to mathematics and science. OCR could include provisions on teacher training in its draft investigative manual as well as issue relevant policy guidance and technical assistance documents.

Finding: Educational research reports that a major influence on girls' decisions to pursue mathematics and science is the kind of interaction they encounter with guidance counselors. Research indicates many counselors tend to steer females away from mathematics and science, particularly away from the upper-level mathematics and science courses. Research also indicates providing inadequate counseling services to girls during elementary and secondary education increases the likelihood they will not enroll in the subjects by high school, and consequently not consider related career fields.

Title IX has provisions regarding nondiscriminatory counseling services for girls in elementary and secondary education, and OCR's draft investigative manual on underrepresentation of girls in upper-level mathematics and science includes guidance for the provision of nonbiased counseling services in mathematics and science to broaden career options for girls. OCR also addresses counseling services in its Title IX implementing regulations. For example, in addition to prohibiting discriminatory counseling services for girls, OCR's regulations require that counselors use the same test or appraisal materials for both male and female students. All of these measures are attempts to eliminate gender bias in the school environment by staff.

Within its resource and technical assistance documents, OCR specifically addresses the counselor's role in eliminating the underrepresentation of females in upper-level mathematics and science in secondary schools. One of the documents includes 10 suggestions that should be undertaken by counselors to encourage girls to participate in these courses.[40]

Recommendation: The Department of Education should work with state departments of education to ensure that the standards for counselors include gender sensitivity training. Individual counselors should work closely with science and math teachers to identify patterns of underrepresentation of girls in upper-level courses and seek to address the factors that may impede girls' access to these courses. High school counselors should also collaborate with their peers at middle and elementary schools to ensure that placement and counseling practices are not resulting in girls being disproportionately unprepared for upper-level courses in higher grades. In the context of career and college planning, school counselors should emphasize encouraging girls to consider nontraditional careers.

---

[39] *See* chap. 6, pp. 93–94.

[40] *See* chap. 6, pp. 92–94.

OCR should conduct periodic compliance reviews to ensure that counselors are providing both boys and girls the same information about educational and career opportunities. OCR should also develop additional technical assistance, outreach, and educational materials, such as promising practices documents, that will help school districts to eliminate gender biases on the part of counselors. Congress and the Department of Education should provide additional funds to the Office for Elementary and Secondary Education and the WEEA office to review and provide training for school counselors.

Finding: OCR recognizes the importance of nondiscrimination in the provision of counseling services by addressing the issue in technical assistance and resource documents. In its resource guidance on counseling, OCR notes that counseling services can improve and expand the service delivery that helps to alleviate the effects of barriers that limit the opportunities of girls in advanced mathematics and science education. OCR provides recommendations for counselors, including:

> (1) hold high expectations for all students; (2) establish a system for the early identification of minority and female students with high interest in mathematics or science; (3) encourage minority and female students to enroll in science and mathematics classes; (4) furnish all students with updated information on careers in mathematics and science; (5) make use of a broader range of professional organizations for career motivational materials and role models; (6) discuss career opportunities with minority and female students in which they have been traditionally underrepresented; (7) help students recognize that economic sufficiency is as important to women as to men; (8) make minority and female students aware that most jobs in the future will require strong math, computer, and science skills; (9) analyze course enrollment data to identify disproportionate enrollment of minority and female students in mathematics and science classes; (10) and monitor minority and female academic achievement and participation in extra curricular math/science activities, including science fairs and clubs.[41]

Another OCR technical assistance document suggests several ways that counselors can avoid "steering girls toward more restrictive career objectives." For instance, OCR states that many counselors acquire the most recent employment forecast information and other changes in the labor force. This information, in conjunction with information on the individual abilities and interests of students, will enable counselors to better advise students on their career options. OCR further recognizes that one method of expanding career options for girls is arranging workshops to give employers the opportunity to present information to counselors about promising new career fields.[42]

Recommendation: OCR's recommendations are comprehensive and well developed and should serve as a foundation for positive counseling practices. School districts should ensure that counselors are aware of their responsibilities to all students and are familiar with the positive practices outlined by OCR. OCR should continue to develop such useful technical assistance tools for teachers and counselors, and should rely upon its own recommendations as guidelines for compliance reviews.

Counselors should be regularly informed of career trends and developments. The Department of Education and the Department of Labor should work together to produce resource documents for counselors that highlight the status of the job market as well as the education necessary for careers in specific fields. Counselors can then help students prepare for the needed training and ensure that students' career interests match their academic preparation.

Finding: Educational research indicates a correlation between gender-biased educational resources and materials and the participation and achievement of girls in mathematics and science. Congress recognized the importance of educational materials in eliminating gender bias when it authorized the Women's Educational Equity Act to fund programs that develop and evaluate model curricula, textbooks, software, and other materials to ensure the absence of gender stereotyping and bias.[43]

Recommendation: Congress should continue to support the elimination of gender bias from curricula, textbooks, and other educational materials by providing additional funding for

[41] *See* chap. 6, pp. 93–94.

[42] *See* chap. 6, p. 94.

[43] *See* chap. 6, pp. 94–97.

programs authorized under the Women's Educational Equity Act. In addition, the Department of Education should work closely with state departments of education and local schools districts to provide them assistance with the detection and elimination of biased course materials. Special funds should be set aside to help underfunded school districts update textbooks and other materials that may contain outdated or biased information.

Finding: Technology is becoming an everyday component in elementary and secondary school classrooms across the nation. The use of computers, satellites, the Internet, and other technological devices in schools is being encouraged from all levels of the Federal Government. The significance of all students having access to technology, being encouraged to learn and participate in the field, and having adequate training in technology is especially critical for girls. Research shows that while technology equipment may be available in schools, there tends to be an unequal distribution of these resources, and girls tend to have less experience and contact with that equipment.

OCR's Title IX regulations clearly prohibit discrimination in access to materials and technology, because under Title IX regulations, benefits and services must not be denied or provided differently based on sex. OCR recognizes the use of computers and access to technology influence enrollment and achievement in mathematics and science, and that access to science and mathematics materials and equipment appears unequal.[44]

Recommendation: The Department of Education should fund studies that examine the use of technology by students of both sexes in those districts that receive federally funded equipment. The purpose would be to assess the use of technology by girls where it has been shown that their contact with the equipment is significantly lower than that of boys and what variables influence their usage patterns. Based on the findings, OCR should develop guidelines to promote initiatives by school districts to provide equal access to available technological equipment and resources for all students.

Finding: Although today's textbooks and classroom materials are less biased than in the past, sexism and racism can still be found. The advent of technology has, in some ways, perpetuated gender bias on a wider level. For instance, one researcher noted that some Web sites and advertisements on the Internet perpetuate gender stereotypes, which has implications for gender equity in schools that use and teach Internet technology.[45] OCR's Title IX regulations themselves do not prohibit the use of gender-biased educational resources or curricular material, because Congress prohibits the Department from regulating the content of textbooks and curricula.[46]

Schools that evaluate instructional resources properly, before their use in the classroom, can encourage girls in advanced mathematics and science courses. School administrators and faculty can filter educational resources that favor one sex over another, and promote the use of educational resources that portray both genders in unique and interesting roles. Evaluating educational material before its introduction in the classroom could help to avoid the use of gender-biased materials, which could diminish girls' self-esteem, lower their performance in advanced mathematics and science courses, and restrict their career options.[47]

Recommendation: Even though OCR cannot regulate the use of textbooks and other educational materials, it can provide technical assistance relating to the types of materials that may be deemed biased. With additional funds, OCR could serve as an information center to answer schools' inquiries as to what types of materials could potentially be biased, and also what practices could be fostering unequal access between boys and girls to other educational resources. OCR should work with OESE to develop a list of ways to identify biased materials (such as in the type and content of illustrations) that schools could use during curriculum development.

Beyond what OCR and the Department of Education can do in the form of technical assistance, the responsibility for ensuring that nonbiased materials are used really falls on school administrators and faculty, who should be con-

[44] See chap. 6, pp. 96–99.

[45] *See* chap. 6, pp. 96–98.

[46] *See* chap. 6, pp. 97–98.

[47] *See* chap. 6, p. 97.

scious as to what constitutes bias. In addition to training educators to detect bias in materials, school districts should keep teachers apprised of new materials and resources as they become available. Teachers should openly discuss bias with their students as they come across questionable instances in materials so that they can intercept the transmission of biases and stereotypes. Students should be encouraged to express their concerns as they encounter materials they may perceive as biased.

Chapter 7. Structuring Academic Programs to Ensure Gender Equity

To be effective in meeting the educational needs of each student, educational programs must be structured in ways that address differences across age groups, ability groups, interests, and curriculum content. One aspect of the structure of educational programs that needs to be considered is within-school grouping of students. Within-school grouping is the broad range of programs and practices that divide students within a school, grade, or classroom. These groupings can be found in advanced placement programs, honors programs, and gifted and talented programs. At the elementary school level, a common form of ability grouping is informal, within-class ability grouping, generally decided by teachers. In secondary schools, the most frequently used method of organizing students is between-class grouping or tracking.

To place students, many school districts use student scores on standardized tests and teacher and counselor recommendations. Schools tend to vary in the extent to which they use a particular method to make mathematics and science placement decisions. The placement criteria can have significant implications, especially for girls and minorities pursuing mathematics and science. The placement criteria such as staff recommendations, course prerequisites, as well as extracurricular activities and available resources, if not addressed properly, can become barriers to mathematics and science education for these students.

OCR has addressed some issues related to admission and enrollment and effective participation as they relate to educational opportunities under Title IX. However, OCR has not addressed the issue of grouping in the context of within-class and between-class pupil placement. In addition, there has not been any Title IX litigation that directly relates to gender equity for girls with respect to methods of assigning students to mathematics and science courses, such as ability grouping and tracking, that can serve as a useful discrimination analysis for OCR to use in its investigations and guidance materials.

One of the primary models for structuring public elementary and secondary schools is the coeducational setting. A challenge to that traditional setting in the form of single-sex education has become part of the discourse for school reform, and has been widely debated as a means for improving education and advancing the goal of gender equity. Advocates of single-sex education argue that there are many benefits to such programs, particularly for girls, and that single-sex education results in positive educational outcomes, increased opportunities, improved sense of self-confidence, and enhanced leadership skills. Opponents of single-sex education not only call into question the legality of segregation on the basis of sex, but also argue that there is no proven educational benefit to separating boys and girls. They argue that single-sex schools do not solve gender-bias problems and that the very stereotypes that advocates of single-sex education seek to eliminate actually thrive in sex-segregated settings.

There is, however, the opportunity to seek middle ground in the single-sex debate. Many lessons can be learned from studying those educational programs that have been successful in improving educational opportunities and replicating them in both the single-sex and coeducational settings. Educators should focus their energy on developing curricula in elementary and secondary schools that emphasize equitable educational opportunities through the integration of innovative teaching techniques and gender-neutral practices.

Whatever the desirability of single-sex education, it remains limited by federal law. The interaction among the Equal Protection Clause of the 14th Amendment, Title IX, and the Equal Educational Opportunities Act of 1974 can be a source of confusion. There have been seemingly confusing decisions in the courts as to the legality of single-sex programs. OCR's Title IX regulations do not necessarily prohibit single-sex schools as long as equal facilities and admission criteria are used for both sexes. With regard to single-sex classes, the Title IX regulations generally prohibit single-sex education with the ex-

ception of separation of students within physical education classes involving bodily contact, human sexuality classes in elementary and secondary schools, and choir classes. OCR has developed a resource guidance for internal use on the implications of sex-based discrimination as it relates to Title IX compliance. OCR has not, however, produced any policy guidance for educators and school officials as to their responsibilities with regard to single-sex programs.

OCR has had relatively few complaints or requests for guidance on single-sex schools or classrooms. In the few instances where OCR has addressed the issue of single-sex classrooms, the schools have avoided being in violation of Title IX by changing the admissions policies of classes to make them open to both boys and girls. In many instances, such as in physical education classes, it is a matter of schools simply not knowing that sex segregation, except for when students are playing contact sports, is not legally permissible. OCR has investigated the issue of single-sex schools in a couple of instances. Generally, if the schools do not have an official policy of excluding one sex, regardless of what the demographic outcome is, there is no violation of Title IX. Similarly, if there are comparable facilities available to both boys and girls, school districts are deemed in compliance with Title IX.

Finding: OCR has not specifically addressed the issue of within-class and between-class pupil placement methods to ensure nondiscrimination in math and science in its Title IX regulations. Because OCR has not issued formal Title IX policy related to underrepresentation of girls in advanced math and science classes, OCR has no document addressing Title IX compliance standards in this area. OCR's investigative manual does, however, discuss compliance standards related to ability grouping and tracking in mathematics and science under Title IX and outlines an investigative approach for OCR investigators to follow in cases related to student placement.[48]

Recommendation: OCR should make it a priority to examine within-class and between-class student placement practices to determine if they are having an adverse effect on girls' participation rates in upper-level math and science classes. As a routine part of compliance reviews, particularly when underrepresentation has been identified, OCR should determine the extent to which these grouping practices result in unequal opportunities for all students. OCR should also issue formal Title IX policy on the underrepresentation of girls in advanced math, science, and technology. OCR is to be commended for its initiative in addressing the issue of student placement in its investigative manual. OCR should now make efforts to regularly initiate compliance reviews in this area.

Finding: Research on student tracking has shown that students who take algebra in eighth grade are more likely to enroll in calculus in high school. This is an important finding because middle school is the point at which boys' and girls' perceptions about their mathematics abilities begin to change, with girls losing confidence over time. By their senior year, this lack of confidence has translated into girls lagging behind boys in enrollment in the most advanced math and science courses, including advanced placement classes.[49]

Recommendation: OCR should work with school administrators and staff to develop technical assistance, outreach, and education efforts designed to ensure that parents are fully aware of the importance of early algebra study for their children. Such efforts should take the form of written materials, seminars, briefings, and public service announcements outlining the benefits of early algebra study, particularly for girls. School administrators and staff should disseminate written outreach materials on this subject at school orientations, parent-teacher conferences, and other opportunities for formal interaction between parents and school staff.

Finding: OCR examines specific criteria used to place students in mathematics and science courses and tracks. These factors include: achievement tests and other test instruments (and whether these tests are properly administered and scored, and that females are periodically retested); counseling and guidance procedures and materials; teacher recommendations (and if their subjective judgments of students' potential are balanced with objective measures

[48] *See* chap. 7, pp. 102–03.

[49] *See* chap. 7, p. 102.

including class tests and grades); and other factors that can affect girls' enrollment in math and science courses. OCR examines these elements to determine if there is disparate treatment on the basis of sex that would violate Title IX. However, OCR will terminate its investigation for potential Title IX violations after examining mathematics and science class enrollment data and finding that: (a) no disparity exists between females' representation in a school's enrollment population and in their representation in advanced mathematics and science classes; and (b) these advanced mathematics and science classes are not gender identifiable. For purposes of targeted compliance reviews, OCR does not look to see whether there is equal or effective participation for girls in classroom interactions between teachers and students. OCR's assumption of Title IX compliance, in the limited context of Title IX compliance reviews, before fully investigating for significant evidence of a Title IX violation based on disparate impact or disparate treatment, can perpetuate potential gender inequities in advanced mathematics and science courses within any academic program at the elementary or secondary level.[50]

Recommendation: OCR should issue Title IX policy guidance in finalized form for equal or effective participation on the basis of gender. Such guidance should be geared toward Title IX in the context of advanced mathematics, science, and technology education.

This policy guidance should address the specific criteria used to place students in mathematics and science courses and tracks. Such policy guidance would assist OCR investigative staff in determining whether there is gender equity within mathematics or science classrooms, particularly the advanced math and science classes such as calculus and physics. In addition, this policy guidance would address aspects of classroom environment that might diminish the potential for equal or effective participation for girls in mathematics and science classes.

OCR should target elementary, middle, and secondary schools for Title IX compliance reviews to examine mathematics, science, and technology involvement and participation among girls. OCR should conduct test case compliance reviews in programs where there is no evidence of physical underrepresentation to determine whether there is any form of bias or adverse impact negatively affecting girls' performance on achievement and aptitude tests, access to course materials, facilities, and computer technologies, their math and science performance, or their interest in advanced placement math and science and future careers in these fields. OCR should focus on developing a compliance strategy that includes indepth interviews with students, parents, teachers, counselors, and administrators on how girls function in their math and science classes. Further, OCR should combine investigative methods with a strong technical assistance, outreach, and education component. OCR especially should focus on equal or effective participation for girls in classroom interactions between teachers and students, and access to materials and computers. OCR should work with schools to remove any barriers to girls' future involvement in math and science programs that affect or limit girls' achievement or interest in pursuing advanced placement coursework, college majors, and/or careers in mathematics, physics, engineering, and computer science.

Finding: Although there will always be debate on the pros and cons of single-sex education, there are many lessons that can be learned by studying those programs that have been successful in improving girls' participation in all curricula, and particularly in math and science. While it must be emphasized that not all girls learn in the same manner, some evidence suggests that girls achieve higher scholastic achievement, particularly in math and science, when taught in a manner different from that in which boys excel. Instructional ideas that emerge from single-sex schools and classrooms could have relevance for coeducational environments and should encourage discussion among educators. A 1998 report by the American Association of University Women advocates the notion that those factors that create positive results in the single-sex environment also exist or can be reproduced in coeducational settings. Further, some educators believe that an unfair burden of proof is placed on single-sex schools to prove their effectiveness, while coeducational schools are rarely asked to prove their effectiveness. Many urge that no single educational format is appropriate for all women or all men, and a range of instructional formats is most likely to

[50] *See* chap. 7, pp. 102–04.

prove effective in addressing different learning styles.

Educators have proposed strategies for making all subjects more gender equitable, such as increasing assigned readings that focus on female experiences, ensuring that science texts depict girls doing experiments as well as boys, and evaluating history texts for whether they portray a complete history with women playing critical roles. Another proposal to capture the educational benefits of single-sex education, while maintaining a coeducational setting, is enhanced equity training for teachers. Such training can ensure that teachers more fully understand the differences in learning styles and hence teaching techniques among and between groups of students. In addition, it can help teachers to recognize the differences between male and female learning styles as they exist in specific ethnic and socioeconomic groups, and to develop a way of determining which students do not conform to the "norms."

A number of effective math and science programs have built upon this idea of altering teaching methods to improve the quality of girls' learning in these subjects, and have assisted teachers in accommodating their instructional techniques to the learning and behavioral style of their female students.[51]

Recommendation: Rather than expending energy debating the issues, educators should focus on developing curricula in elementary and secondary education that emphasize equitable educational opportunities within all classrooms and in all academic subjects through the integration of innovative teaching techniques and gender-neutral practices in the coeducational setting. Because children all have different learning styles and strengths, educational policies should be flexible to try to incorporate multiple teaching perspectives and styles.

The Commission supports the recommendation of the Department of Education that the educational community should launch efforts to consider a wide array of outcomes that apply equally to coeducational and single-sex environments. Educators should rely on multiple measures of success to determine the efficacy of an institution's curricula, staff, teaching techniques, and educational philosophy. The Department of Education should also be tolerant of differences in educational structure that may benefit a specific population or community and should encourage the exploration of alternative methods of education in traditional educational settings.

Enhanced equity training for teachers could be a viable alternative to single-sex schooling. All teachers, regardless of the educational structure, must understand the differences in learning styles and hence teaching techniques among and between groups of students. Teachers must be trained to recognize the differences between female and male learning styles as they exist in specific ethnic and socioeconomic groups. Further, programs focusing on alternative teaching methods should be replicated in both single-sex and coeducational schools to ensure improved math and science participation and performance of female students.

Finding: The Title IX regulations do not preclude a school district from using single-sex schools with certain qualifications. Instead, the regulations prohibit state and local educational agencies that are recipients of federal funds from excluding any person on the basis of sex from admission to any educational institution unless there are comparable facilities, courses, and services for both sexes. There has been a proliferation of single-sex schools and programs in the past few years designed to help girls perform better in academics, particularly advanced math and science. However, OCR has done few compliance reviews in this area.[52]

Recommendation: OCR should target these programs by working with state and local educational agencies. OCR should conduct compliance reviews to determine whether these programs are educationally necessary and that there are comparable facilities and equal access to all educational resources (including teachers, counselors, curricula, and instructional materials) for boys. OCR should carefully evaluate whether the program is actually serving the purpose for which it was created. In particular, OCR should carefully evaluate programs to ensure that necessary resources are not being funneled away from the regular educational program to support a special program such as single-sex schooling.

---

[51] *See* chap. 7, pp. 104–09.

[52] *See* chap. 7, pp. 109–10.

In addition, OCR should work closely with school administrators to ensure that future single-sex educational programs are developed and implemented within the letter of the law.

Finding: The interaction among Title IX, the Equal Protection Clause, and the Equal Educational Opportunities Act can be a source of confusion. There have been seemingly conflicting decisions in the courts as to the legality of single-sex programs. The Supreme Court's interpretation of equal protection in relation to single-sex education remains largely undefined. The Court used the Equal Protection Clause to strike down the single-sex admissions policies of two public undergraduate institutions, but has not ruled explicitly on the constitutional permissibility of single-sex schools and classes at the elementary and secondary levels. Although OCR has issued recent guidance on Title IX and sexual harassment, it has neglected to develop a similarly comprehensive policy guidance document on the single-sex educational issue, an equally timely issue given the proliferation of single-sex schools and the conflicting decisions in the courts as to the legality of such programs under Title IX.[53]

Recommendation: Because of the confusion surrounding the legality of single-sex education and the proliferation of single-sex programs in recent years, OCR should develop guidance for students, teachers, parents, and school administrators to clarify the duties imposed on educational institutions by the Equal Protection Clause and Title IX. The Department of Justice, which has enforcement responsibility for the Equal Educational Opportunities Act, should issue policy guidance on that statute in collaboration with OCR. This document should be targeted toward recipients of DOEd funding as well as investigative staff. It should contain a detailed discussion of Title IX and its implementing regulations clarifying the law's requirements with regard to both single-sex schools and single-sex classes, perhaps addressing each in an individual discussion. The document should contain a thorough recitation of applicable case law that clearly explains how the standards applied in each decision inform OCR compliance analysis for determining the legality of a single-sex school or class under Title IX. The document also should provide illustrative examples to show how a given scenario might play out from a real-world context. Finally, this document should be disseminated widely among recipients to ensure that OCR has informed as many educators as possible of their responsibilities under Title IX in single-sex education.

---

[53] *See* chap. 7, pp. 109–14.

Statement by Chairperson Mary Frances Berry, Vice Chairperson Cruz Reynoso, and Commissioners Christopher Edley, Jr., Yvonne Y. Lee, and Elsie M. Meeks

There are numerous serious problems inhibiting equality of opportunity in our country today. One is the plight of young African American males in our cities—the subject of a Commission consultation last year, and the topic of a planned follow-up proceeding to consider solutions that have worked in some locales. Although most students attend schools that provide an effective education, there are specific problems that interfere with the pursuit of a quality education for all. The segregation of students by race and national origin in inadequate low-performing schools and the impact of zero tolerance policies are among the issues that have drawn the attention of the Commission.

This report on removing remaining barriers to gender equity in advanced mathematics, science, and technology education addresses another important issue. It is one in a series of reports prepared by the Commission's research and evaluation staff in the performance of our mission, to ensure the effectiveness of federal civil rights enforcement efforts.

This particular report pays attention to gender disparities in order to evaluate the performance of the Office for Civil Rights in the Department of Education (DOEd) in enforcing Title IX of the Education Amendments of 1972. Statutory reports of this kind are based on a review of the social science literature and data concerning OCR's enforcement efforts produced by the DOEd. These reports are not designed to challenge the validity of the particular civil rights laws under study, but to evaluate the effectiveness of agency enforcement.

The dissenters, whose statement begins on page 156, voted to instruct the staff to prepare the Equal Educational Opportunity reports, including this one, *Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX*. The staff made revisions to the report, after it was initially rejected by the Commission on a 4–4 vote. When the revisions were completed, the Staff Director distributed the report to the Commissioners for consideration, and the Chairperson placed it on the agenda for the next Commission meeting. The timing of reports for Commission consideration is determined by the date of completion by Commission staff, not according to events that may affect the agency under review. The passage of this report was in no way related to guidelines on testing released by the Department of Education, and to suggest so is ludicrous. To be explicit, the Commissioners who voted for this report had no prior knowledge of the guidelines' release date established by the Department of Education.

The Commission has in the past done work on standardized testing and may do so again, but this report is not focused on standardized testing of the high-stakes variety or any other kind. The Commission voted 5–2 to approve this report. The dissenters waited until the dissent was filed to point out what they regard as "factual errors." The usual practice is for each Commissioner to point out any needed corrections when the report is reviewed and then discussed in the Commission meeting. Editing to clarify points that appear unclear is also routinely part of this procedure.

Because of these unusual circumstances, we are including a staff response in our statement. We hope that this report will assist the Department of Education in improving its enforcement of the civil rights laws.

Statement by U.S. Commission on Civil Rights, Office of Civil Rights Evaluation Staff

Introduction

It often seems like the search for real answers to the problems confronting American society is doomed from the start because the process of identifying what the problems really are all too often is influenced by the prejudices of those leading the search. This is particularly true of equality of opportunity in our education system, especially it seems with regard to gender equity. The facts concerning the differences in achievement and participation rates between boys and girls in upper-level math and science courses are analyzed in this report in the context of a handful of assumptions and values that most Americans probably share. The first is the belief that we should all be given the opportunity to develop our talents fully. Second, regardless of the source of these differences, there is no good reason to consciously or unconsciously direct girls away from fields they might otherwise choose, particularly since these fields are generally among the more lucrative and rewarding in society today. Third, the government may play a useful role in helping determine the extent to which girls are being "steered" and—to the extent to which this is a problem—help to rectify it.

Equal Educational Opportunity and Nondiscrimination

The report's title refers to "equal educational opportunity and nondiscrimination." While these terms are related, they are not synonymous. The use of both terms is not a redundancy but rather a precise distinction that reflects clearly the objectives of the report. Each is an aspect of the main focus of the report, the enforcement efforts of the Department of Education's Office for Civil Rights (OCR). While the primary mission of OCR is to seek out violations of federal statutory civil rights law, this is not its only mission. It also is tasked with promoting equal educational opportunity. While the term discrimination is a purely legal term that has its basis in the statutory language of Title IX and may be viewed as the basis for a violation of that law, the scope of the report is broader than a legal review of discrimination in violation of this statute. It also assesses the role and responsibility of the Department of Education in ensuring equal educational opportunity.

Equal educational opportunity is a term that has been applied in a variety of contexts, including law and social science. However, it remains a term that has not been clearly defined. The report focuses on equal educational opportunity as a means of identifying and analyzing existing barriers for girls in math and science. The report recognizes that these barriers may not, in fact probably often do not, constitute violations of federal civil rights statutory laws, such as Title IX. The well-documented barriers to equal educational opportunity, if not confronted, can have a negative effect on girls' future endeavors, such as career choice. The report demonstrates these important obstacles—including socialization, parental influence, teacher and counselor steering—because they are relevant to the Department's mission to ensure equal educational opportunity for girls, a mission related to but distinct from uncovering Title IX violations.

Ultimately, the report seeks to present the position that, while it is true the pool of girls with the interest in and desire to pursue a career in math and sciences may be statistically smaller than that of boys, even if one girl with the talent and desire is dissuaded from pursuing a career in math and science, due to such barriers, then there is a problem to be addressed. Resolution of this problem requires uncovering practices that constitute discrimination in violation of Title IX, thereby precluding existent barriers from resulting in the denial of equal educational opportunity.

The Evidence Persists: Dispelling the Myth of Gender Equity

This report relies on statistics compiled by a variety of sources, and the themes expressed in it are recurrent in education, sociology, and psychology literature. Nonetheless, it has been criticized for relying too heavily on the research of the American Association of University Women (AAUW). Although the 1992 AAUW study, *How Schools Shortchange Girls*, has been discredited by some, it was revised and updated in 1998, and subsequent AAUW studies have been cognizant of past criticisms.

While the AAUW has conducted several studies relevant to this research, it was not the only organization relied upon for this report. Much of the primary evidence presented here comes from the U.S. Department of Education (DOEd) itself. A review of several of the most recent data sources prepared by DOEd's National Center for Education Statistics show differences in scores that the Federal Government and other scholars need to more closely examine. In addition, in 1999, Commission staff contacted DOEd's OCR and the College Entrance Examination Board, which administers the Scholastic Achievement Test, and ACT, Inc., which administers American College Testing (ACT), for updated data relevant to the issues under review. Further, agencies well respected in many circles, such as the National Science Foundation, have been be compelled to develop programs specifically designed to improve girls' and women's opportunities in these subjects and have produced much literature in the area.

This report followed the methodology and format of the previous volumes of the *Equal Educational Opportunity Series*. All of these reports have focused on five principles: (1) structuring educational programs to serve a diverse student population; (2) using neutral and nondiscriminatory diagnostic and screening procedures when placing students in educational programs; (3) providing parental notification and ensuring that institutional programs facilitate and encourage the involvement of parents in their children's education; (4) evaluating and allocating teachers, facilities, and other resources among educational programs; and (5) eliminating barriers, providing access to all subjects, activities, and career opportunities, and counseling each student to maximize his or her potential.

To that end, in the present report, Commission staff sought to incorporate the latest educational literature related to these five principles, particularly with regard to girls and women in math, science, and technology courses. For example, chapter 5 presents "classical" studies by the College Board on neutral and nondiscriminatory screening and diagnostic procedures, as well as newer research published in journals such as *Phi Delta Kappan, Educational Measurement: Issues and Practice,* and *Journal of Economic Education,* which support earlier research and indicate that differences between boys and girls, and men and women, in testing outcomes persist. In addition, the newly updated draft guidance, *Nondiscrimination in High-Stakes Testing: A Resource Guide*, which was first issued by OCR in April 1999, was referenced. Similarly, Commission staff consulted recent editions of educational journals, including *Journal for a Just and Caring Education* and *Teaching Children Mathematics*, for the discussion in chapter 6 on parents, teachers, and counselors.

Much of the information reviewed by Commission staff indicate that there is sufficient evidence to suggest that more than stereotyping, self-esteem, personal choice, and socialization are the cause for differences between boys and girls in math and science education outcomes. In the rare instances where reports were found disputing the overwhelming evidence of gender disparities in math, science, and technology education, appropriate citations were included. For example, a 1994 poll conducted for the National Action Council for Minorities in Engineering found that middle school and high school girls reported being *more* likely than boys to be encouraged to pursue advanced math and science courses. However, evidence from several other sources suggested the opposite. Nonetheless, the Commission included the results of all the studies it found, in order to let the readers draw their own conclusions. This broad spectrum of educational research was accompanied by evidence of OCR's efforts to address these issues in an attempt to provide a balanced report that demonstrates both the need for intervention and the agency's inadequate response.

The Impact of and the Need for Continued Enforcement of Title IX

The success of Title IX of the Education Amendments of 1972 attests to the importance of continued strong enforcement of the act by the U.S. Department of Education. The law has had an enormous impact on women's educational opportunities. Title IX has opened the door to women in many areas, including intercollegiate sport and higher education. Women are now found in higher numbers in postsecondary education than men, more girls take math and science courses than ever before, and many overt barriers to girls' participation in educational programs (particularly sports) have been removed.

However, there remain several areas in which girls have not yet achieved comparable success, including technology subjects and the most advanced math and science courses, which are the focus

of this report. It is understandable that some might be hesitant to acknowledge the disparities that exist between boys and girls, particularly given the degree of progress girls and women have made in recent years. Commission staff, upon close evaluation, found differences that indicate inequities in math, science, and technology education, including the counseling students receive, the negative effects of sexual harassment, and a subtle—and not always conscious—steering away of girls from math, science, and technology education. We cite findings that although girls are now found in healthy numbers in algebra II, geometry, and calculus courses, boys remain more likely than girls to take courses beyond algebra II. There are several other facts that are cause for alarm, including:

- By the 12th grade, boys' science achievement test scores are significantly higher than girls' test scores.
- In 1999, males scored 36 points higher than females on the math portion of the SAT; on the physics SAT subject test, boys scored higher than girls by 44 points.
- More boys than girls are found in computer math, computer programming, advanced technology, and AP physics courses, while girls are more often found in word processing courses.

It is also curious that women continue to lag behind men in the receipt of college and postgraduate degrees in technological fields. Although the timing of this report did not allow for a statistical analysis of the evidence, anecdotal evidence suggests that counseling, sexual harassment, and other potential violations of Title IX, combined with societal factors, may work to steer women away from such fields. Indeed, the evidence of sexual harassment in the engineering and science fields, in college and beyond, suggests that women leave the fields because of the degree of harassment.

The Role of the Department of Education

With this report, we found that DOEd's OCR does not *vigorously* enforce Title IX with respect to girls (and boys) in math, science, and technology education. Few compliance reviews in this area have been done, and those that have been done have been inadequate. The persisting differences in achievement scores, participation in higher-level courses, and degree completion in these areas are sufficient evidence to compel OCR to do more work in this area. Therefore, the Department of Education needs to expand its compliance reviews and to take into account more evidence than simply percentages of boys and girls enrolled in math and science courses. DOEd's Office for Civil Rights should take a closer look at higher-level math, science, and technology courses, including computer programming. Also, working with other agencies, such as the Women's Bureau at the Department of Labor and the National Science Foundation, OCR should ensure that information on the multitudes of career options is made available to *all* students.

Further, OCR fails to determine if girls are counseled in the same manner as boys with regard to math, science, and technology course taking. OCR also fails to determine the extent to which sexual harassment occurs in math, science, and technology courses, which several authors have suggested may influence the striking absence of women in postgraduate math, science, technology, and engineering programs. This is an anomaly in an era where women are earning master's and doctoral degrees in increasing numbers. It is particularly important that OCR expand its efforts to take a close look at technology-related courses, such as computer programming and computer engineering, which have just recently entered the education horizon. OCR must ensure that boys and girls are given equal opportunities to participate in such classes, which includes equal encouragement and equal information about the future benefits of doing well in such courses.

Conclusion

Women and girls have made and continue to make impressive gains in education. This is perhaps the one point that those on all sides of the issue will acknowledge, and in fact it is stated in numerous places throughout the report that indeed the educational climate has been markedly improved for women and girls. The fact that there is still room for improvement cannot be ignored, however, particularly in light of the gender differences still exhibited in participation in science and technology careers. It is often asked why, if girls are shortchanged, women are more likely to obtain postsec-

ondary degrees. However, again, although more women earn bachelor's and master's degrees, they are not doing so in the lucrative fields of math, science, and technology. It should be reiterated that the present report, volume V of the Commission's *Equal Educational Opportunity Series*, is about the enforcement of Title IX with respect to girls in math, science, and technology education.

Critics of this report have argued that the greatest achievement gaps in America have to do with race, not sex. This report is not intended to single-handedly address all areas where educational disparities exist, nor is it intended to lessen the importance of the discrimination or unequal opportunities faced by other groups of students. It is one in a series of reports undertaken by the Commission to look at the effects of bias on various groups of students, including students with limited English proficiency, students with disabilities, students of color, and female students. While this report stands alone on its merit, it is intended to portray but one of the many educational shortcomings that in effect limit equal opportunities. Readers are encouraged to read other reports in the series for a more complete picture of the status of education in this country.

Statement by Commissioners Carl A. Anderson and Russell G. Redenbaugh

Two years ago, the Commission rejected the original version of this report, *Equal Educational Opportunity and Nondiscrimination for Girls in Advanced Mathematics, Science, and Technology Education: Federal Enforcement of Title IX.* This revision contains, at a minimum, the same serious flaws as its predecessor. We strongly object to the revising of the report without a vote of the Commissioners authorizing such an undertaking. We continue to object to its findings and recommendations. Our major concerns include the following:

- *The report's conclusion—that there is widespread bias against girls and women in the Nation's schools—is not supported by any of its data.* Many of the statistics cited in the report, as well as a number of more recent and more credible studies, tell a much different story: Girls and women have made and continue to make impressive gains in both K–12 and higher education. Women are finding more support and earning more advanced degrees than ever before.

- *The report does not articulate a sound methodology, nor does there appear to be one.* The methodology used in the report is never explained, and it is evident that no outside experts in the fields of math and science achievement were consulted. The report reaches conclusions—for instance, that differences in test scores are due to bias—without articulating the methodology used to establish cause and effect.

- *The report fails to present a balanced and fair discussion of the issues.* As evidenced by an astounding number of cites to the American Association of University Women (AAUW), the Commission's report is basically an advocacy report for an advocacy group. Alternative viewpoints are either given just cursory mention or altogether omitted. In fact, other than the section on single-sex education which gives views from both sides, the report is remarkably one-sided.

- *The report makes numerous assumptions that have no basis in fact.* For example, it alleges that girls are being "steered" away from fields they might otherwise choose; that parents, teachers, and counselors inappropriately "direct" them away from these fields because of a conscious or even unconscious bias; and that it is appropriate for the Federal Government to step in to steer, in loco parentis. But the report provides no facts to support these assumptions and some that contradict them. In the absence of complaints or evidence of injury, there is no basis to assume, as this report does, that girls are unable to make their own choices or individual decisions and that they passively endure discrimination or "steering" out of fields that truly interest them. Moreover, if girls are being "shortchanged" or discriminated against, why are they more likely to attend college and earn bachelor's and master's degrees than boys? Why do girls consistently earn higher grades as high school students than boys in the face of such discrimination? Why has the annual total of women receiving Ph.D.'s increased by more than 50 percent over the past decade, growing at twice the rate of the number of men getting those degrees?

- *The report defines equity in terms of "equal outcomes" rather than "equal opportunity."* By insisting that gender equity is nothing less than equal outcomes, whether measured by test scores, career choice or income, the report also assumes that any disparities in outcome must be due to discrimination. The anthropological assumption here is that both genders are identical in terms of values, interests, and abilities. In fact, psychologists have documented substantial differences between males and females in these areas. Further evidence demon-

strates that it is virtually inconceivable that these differences are due primarily to "gender socialization" as this report assumes. The report provides no basis for its assumption that statistical parity by sex can be achieved in each and every field and that government engineering can effect such an outcome.

- *This report was soundly rejected by the Commission two years ago, the revision process was never authorized, nor were specific revisions discussed in any detail by the full Commission.* A side-by-side comparison of the current version of the report and the original draft clearly shows that the most extensive changes that have been made are in the sections on "high-stakes" testing. This suggests that the report has been resurrected not so much to address gender inequities, but rather to serve as a vehicle for attacking standardized tests and questioning their legitimacy as a tool in higher education admissions policy. A disproportionate amount of the new material in the present report consists of a broadside against these tests and recommendations for vastly increased government investigation of them. Is it mere coincidence that the Commission's report was approved on December 12 (a Friday), and on December 15 (the next Monday) the Civil Rights Office of the Department of Education released new draft "guidelines" regarding the use of standardized tests?

Examples of Methodological Problems and Their Effects

The lack of methodology and adherence to standards for scholarly research raises serious questions about the factual accuracy of this report and its conclusions. Sweeping accusations are made (e.g., "many girls are not encouraged at home, and parents tend to provide more encouragement in mathematics and science to their sons") based on sources that tend to be either outdated or, in some cases, reflect the unpublished work of graduate students. Other sources, such as the reports by advocacy groups like the American Association of University Women, are quoted when the content is consistent with the desired conclusion and ignored when it is not. This is not an acceptable practice for any government agency.

The section on gender bias in standardized testing is a case in point. Citing selected "critics of testing" (and in some cases referencing sources that are more than a decade old), the report makes a number of general assertions about "test bias" as a barrier to the participation of girls in advanced mathematics and science education. Almost buried in this discussion is the acknowledgment "that because one group scores higher on a test than another group or groups, it does not necessarily mean that the test is biased." The report then prescribes various standards for eliminating gender bias on tests, but there is no mention of the fact that these recommendations are already in place at testing agencies. For example, the report recommends that tests such as the SAT be examined for gender bias—presumably on the assumption that this is not part of the test development process, when in fact it is. Since 1980 the Educational Testing Service has had a comprehensive "fairness review" process. A document that describes it is on the Internet. It is eight pages long and far more sophisticated than the discussion in this report. It does not reflect well on the Commission to try to build a charge of bias by ignoring the many steps taken to ensure test fairness.

In addition to the practice of selective quotation, the report contradicts itself. For example, in its introduction the report alleges that girls face indirect barriers to equal opportunity in advanced math and science, including a lack of encouragement from parents, teachers, and guidance counselors. However, the next chapter presents data refuting that claim:

> For instance, among 9th to 11th graders, 70 percent of girls and 68 percent of boys reported being encouraged by their parents to take more advanced mathematics and science classes; 64 percent of girls and 58 percent of boys were encouraged by their teachers; 52 percent of girls and 40 percent of boys were encouraged by their guidance counselors.

Errors of fact are evident throughout the report. The report acknowledges, for example, that "girls have made progress in advanced mathematics and science, earning comparable grades and exhibiting similar course-taking patterns in these subjects." It then goes on to argue that "girls are less

likely than boys to take courses beyond algebra II." However, this appears to be false. In chapter 3 a table from the National Center of Education Statistics shows that more girls than boys are taking math courses beyond algebra II. According to recent studies, this is because girls, generally, follow more rigorous academic programs than boys so that they can meet the demands of competitive colleges and universities, and more girls than boys are bound for those institutions.

The report also notes that fewer girls than boys take advanced placement tests in calculus. This is accurate. Approximately 7.2 percent of high school males and 6.7 percent of high school females enroll in advanced placement calculus. What the report never explains is how this small gender difference demonstrates that girls are "lagging behind" or how it can possibly constitute a civil rights problem. There are much larger gaps that favor girls—for example, in writing and reading achievement, and in advanced placement in history and biology. In fact, a review of statistics related to overall achievement shows boys, not girls, on the weak side of a widening educational gender gap. According to the data from the National Center for Education Statistics, boys tend to earn lower grades, to be less committed to school, and less likely to go to college.

Lack of Balance

A report that is ostensibly concerned with equity should present dissenting views. In this case, experts who dispute the "women as victims" perspective should certainly have their own viewpoints thoroughly discussed. Instead, this report is essentially a repackaging of claims first issued by the AAUW almost a decade ago—allegations which since that time have been thoroughly discredited. Studies disproving the AAUW's claims are either ignored, given but a passing mention, or buried in the footnotes. We would note, in particular, the American Enterprise Institute's study, *Women's Figures: An Illustrated Guide to the Economic Progress of Women in America*, by Diana Furchtgott-Roth and Christine Stolba; Christina Hoff Sommers' *Who Stole Feminism?*; and Dr. Judith S. Kleinfeld's *The Myth That Schools Shortchange Girls: Social Science in the Service of Deception*. The essence of these works—all of them written by credible scholars—is nowhere to be found.

Moreover, as several experts, including Dr. Kleinfeld, have pointed out, the greatest achievement gaps in America have to do with race, not sex. As Dr. Kleinfeld puts it, "The shortchanged group is hardly female—it is African-American males." Instead of squandering time and staff resources in resurrecting this report, the Commission should have looked at a more valuable endeavor—i.e., building on the consultation that was held regarding the "Crisis of the African American Male." Also, focusing on a bogus crisis diverts attention away from another serious gap—the deteriorating performance of American students compared to international students in advanced sciences and mathematics. In 1994, students from the U.S. earned only 53 percent of the doctorates in mathematics and the physical sciences awarded by American universities. That is arguably not a civil rights issue, but, then, neither is the one in this report, at least as the case is presented here.

The Real Issue: The Attack on Standardized Tests

Because the report's conclusions about gender inequity are largely unsupported by facts, it appears that the real issue lies elsewhere. Specifically, we find troubling evidence that this report is really a Trojan horse for attacking standardized testing under the guise of gender concerns. It prescribes various standards for eliminating gender bias on tests without even considering that these are already in place at testing agencies. It recommends that tests such as the SAT be examined for gender bias on the assumption that this is not already part of the test development process when, in fact, it is. The report fails to acknowledge the many steps that have been taken to ensure test fairness and implies, without any sound evidence, that "high-stakes" testing is inherently discriminatory. Nowhere in the report are the testing agencies given a chance to respond to such a serious charge. The net effect of the charge and recommended interventions by government would be to tie the hands of testing agencies for years and perhaps reduce their use or, at minimum, question their validity. If the Commission is going to head in that direction, a far more scholarly, comprehensive, and informed approach is requisite.

Conclusion

Congress has made clear that it did not intend Title IX to become a quota machine. Still less did it intend this Commission to become one. Yet by calling for increased, heavy-handed Federal interference into the Nation's classrooms to effect statistical parity by gender, this report advocates exactly that—quota-driven bureaucracies justified by bizarre interpretations of both Title IX and this agency's mission. The destructive policies conveyed in the findings and recommendations, which cannot be supported or justified by the data presented, would undermine the choices of American students, stress proportionality over excellence as the national ideal, and overwhelm the courts with frivolous and pernicious lawsuits. There is a crisis in education in this country today; but it has nothing to do with gender disparities in opportunities to pursue education in advanced math and science. Rather, the real crisis is that so many students—male and female—are trapped in failing schools that deny them the opportunity to fully develop the skills they will need to enter specialized fields and participate effectively in the Nation's work force.

U.S. GOVERNMENT PRINTING OFFICE 2000-468-348/20398

U.S. COMMISSION ON CIVIL RIGHTS
Washington, DC 20425

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

BEST COPY AVAILABLE